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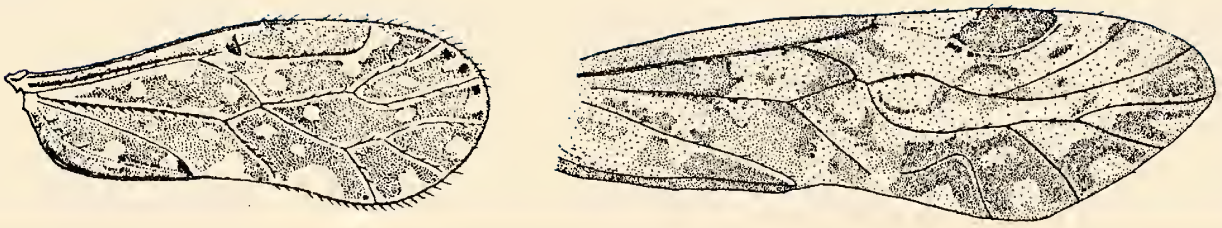

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A Revision of *Storenosoma* Hogg and Description of a New Genus, *Oztira* (Araneae: Amaurobiidae)

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ABSTRACT. The genus *Storenosoma* Hogg, 1900 is revised and now contains thirteen species, *S. hoggi* (Roewer), *S. altum* Davies, *S. supernum* Davies, *S. terraneum* Davies, *S. bifidum* n.sp., *S. bondi* n.sp., *S. forsteri* n.sp., *S. grayi* n.sp., *S. grossum* n.sp., *S. picadilly* n.sp., *S. smithae* n.sp., *S. tasmaniensis* n.sp., and *S. victoria* n.sp. A new genus, *Oztira*, is described to contain Australian species previously ascribed to the New Zealand genus *Otira* Forster & Wilton. *Oztira* contains four species, *Oz. affinis* (Hickman) n.comb., *Oz. aquilonaria* (Davies) n.comb., *Oz. summa* (Davies) n.comb., and *Oz. kroombit* n.sp. The relationships between *Storenosoma, Oztira, Otira* and *Pakeha* are discussed.

MILLEDGE, G.A., 2011. A revision of *Storenosoma* Hogg and description of a new genus, *Oztira* (Araneae: Amaurobiidae). *Records of the Australian Museum* 63(1): 1–32.

The genera *Storenosoma* Hogg and *Oztira* n.gen. (Fig. 1a–c) contain ground dwelling ecribellate amaurobiid spiders of small to moderate size which appear to be free living terrestrial hunters. They are characterized by the strongly procurved eye rows, with the PLE and sometimes the PME being considerably larger than those of the anterior row. The eye pattern and body colouration give them a superficial resemblance to wolf spiders, as noted by Hogg (1900). At present, they are only known from eastern and south eastern Australia.

The genus *Storenosoma* was placed in the Zodariidae by Hogg (1900) and synonymized with *Storena* Walckenaer 1805 by Roewer (1942). It was subsequently removed from synonymy with *Storena*, although not explicitly stated, and transferred to the Amaurobiidae by Davies (1985). Hogg (1900) described a single species in *Storenosoma, S. lycosoides* Hogg, 1900, from Macedon in Victoria. When Roewer (1942) synonymized *Storenosoma* with *Storena* he provided a replacement name, *S. hoggi* Roewer, 1942, for *S. lycosoides* which was believed to be preoccupied in *Storena*. A further three species were described by Davies (1986) from north eastern New South Wales and South Eastern Queensland. Examination of large numbers of specimens in museum collections has revealed a further nine species which are described here. Two genera that appear closely related to *Storenosoma, Pakeha* Forster & Wilton, 1973 and *Otira* Forster & Wilton, 1973 (Fig. 1d–e), were described from New Zealand. These three genera are all linked by the possession of retrolateral stridulatory spurs on the male palpal trochanter (Fig. 3c). The relationship between these three genera was recognized by Davies (1986). Hickman (1981) described a new amaurobiid species from south western Tasmania, which he ascribed to *Otira, Ot. affinis* Hickman. Davies (1986) added two further species, *Ot. summa* Davies and *Ot. aquilonoria* Davies, from north eastern Queensland. Examination of a number of specimens of Australian *Otira* has revealed one new species from south eastern Queensland. In addition, it has been concluded that the Australian species differ enough from their New Zealand counterparts to warrant the erection of a new genus, *Oztira*.

These genera are currently placed in the Amaurobiidae. However, the cladograms of Davies (1998, 2000) place

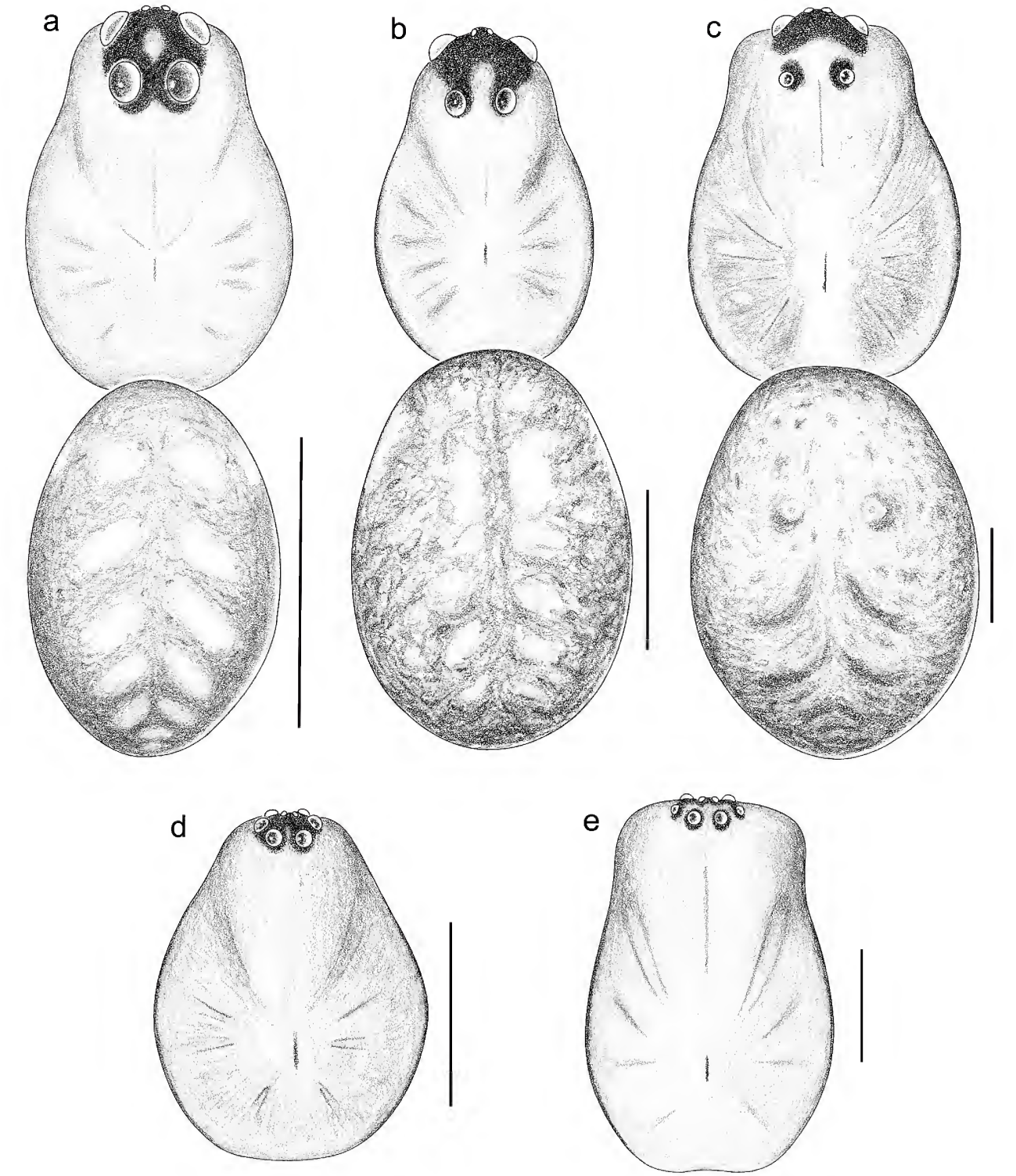

Fig. 1. Cephalothorax and eye pattern. *(a) Oztira affinis, (b) Oztira kroombit, (c) Storenosoma hoggi, (d) Otira satura, (e) Pakeha protecta.*

Storenosoma and *Storenosoma* + *Otira* as sister groups to *Tasmarubrius* Davies, 1998 which Davies places in the Amphinectidae. Later though, Davies (2002) states that "there is no clear diagnosis of the family Amphinectidae". In light of this, and the fact that it is beyond the scope of this study to attempt a further higher level analysis of the Amaurobioidea (sensu Forster, 1970), *Storenosoma* and *Oztira* are left in the Amaurobiidae.

Materials and methods

Specimen examinations, measurements and drawings were made using a Leica MZ8 or Olympus SZX16 microscope with graticule and drawing attachment. Specimen preparations for scanning electron microscopy utilized an air dried specimen which was directly mounted to a stub. All specimens were coated with gold and viewed

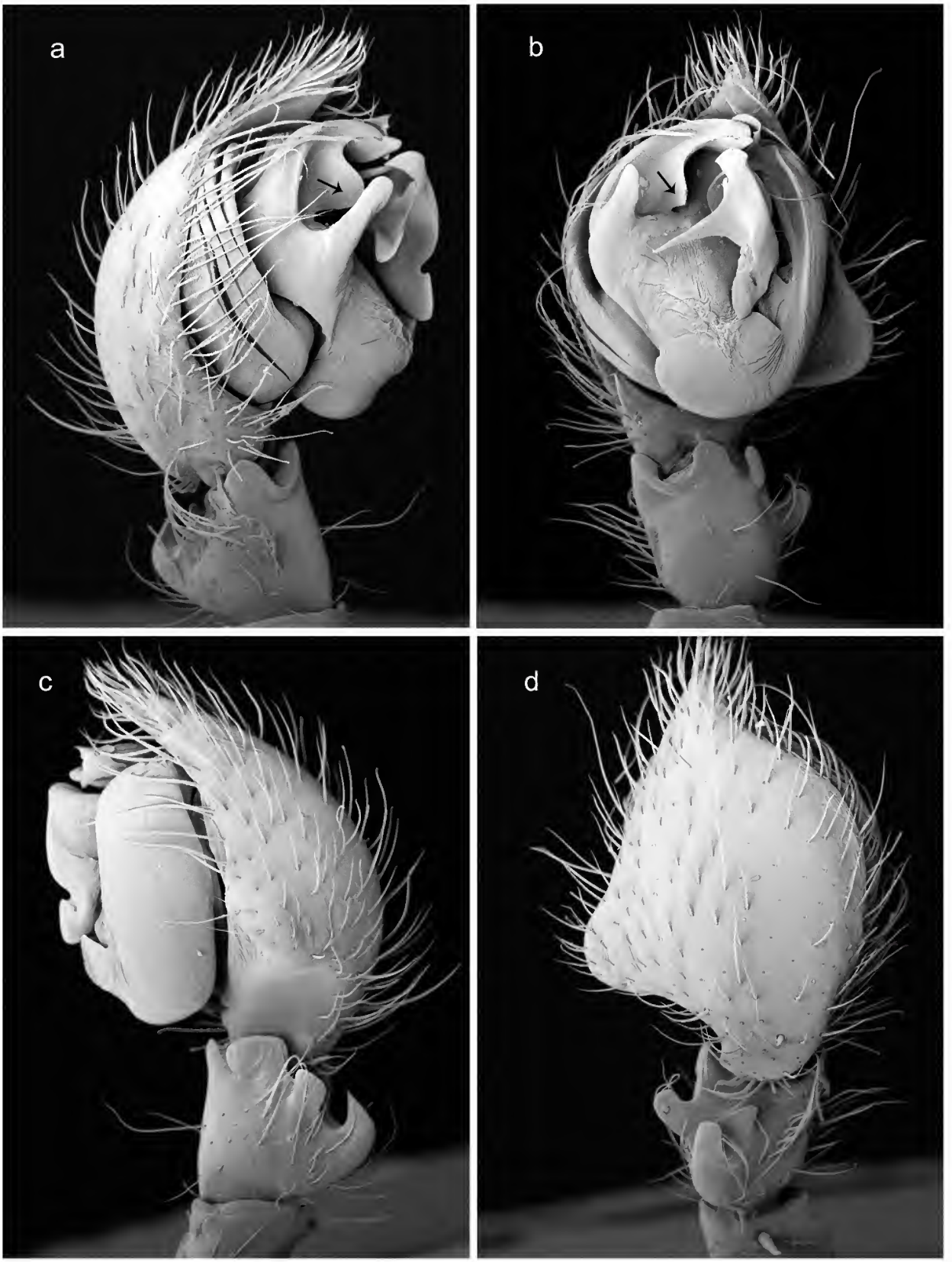

Fig. 2. *Storenosoma hoggi* (KS71594), male palp (arrows indicate basal expansion of embolus). *(a)* prolateral, *(b)* ventral, *(c)* retrolateral, *(d)* dorsal.

using a Zeiss Evo LS15 SEM incorporating a Robinson backscatter detector. Internal details of female genitalia were drawn from an excised epigynum cleared in lactic acid or 10% potassium hydroxide solution. Cleared epigyna were returned to 70% ethanol for storage after drawing; SEM preparations are kept separately in a dehumidified cabinet. Plates were composed using Adobe Photoshop (7.0 and Elements 2.0). Measurements are in millimetres and, except

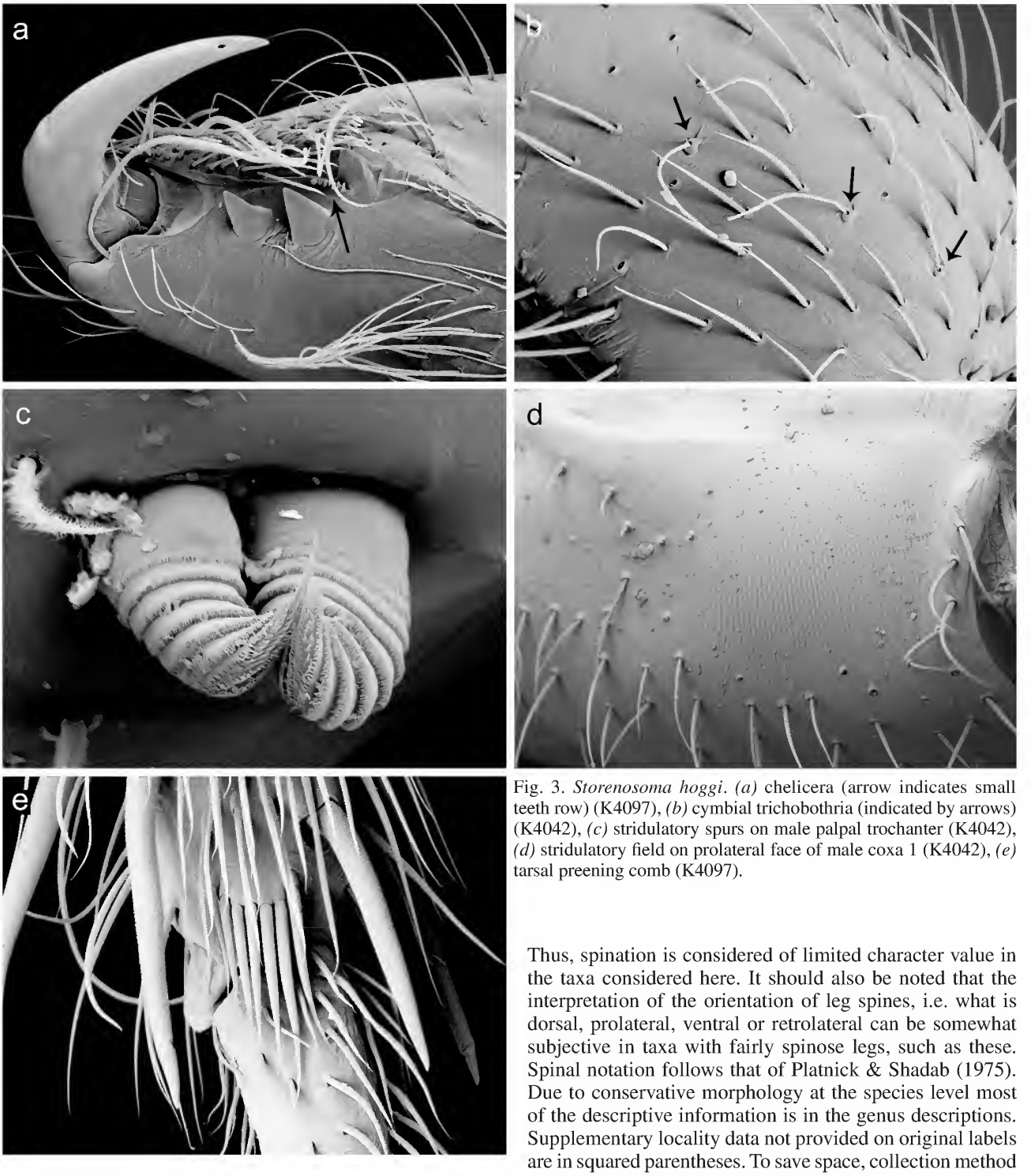

Fig. 3. *Storenosoma hoggi*. *(a)* chelicera (arrow indicates small teeth row) (K4097), *(b)* cymbial trichobothria (indicated by arrows) (K4042), *(c)* stridulatory spurs on male palpal trochanter (K4042), *(d)* stridulatory field on prolateral face of male coxa 1 (K4042), *(e)* tarsal preening comb (K4097).

where stated, are of the holotype and a paratype of opposite sex. The left male palp is illustrated except where indicated. The RTA has not been subdivided into dorsal, retrolateral, ventral and prolateral categories as suggested by Griswold *et al.* (2005) because it is not always clear in the taxa considered here that these elements are separate. Leg spine counts are given for a male of the type species of each genus only. This is due to the rather conservative spination pattern in these genera and the fact that spine numbers can vary slightly within and between individuals, as noted by Hickman (1981). Thus, spination is considered of limited character value in the taxa considered here. It should also be noted that the interpretation of the orientation of leg spines, i.e. what is dorsal, prolateral, ventral or retrolateral can be somewhat subjective in taxa with fairly spinose legs, such as these. Spinal notation follows that of Platnick & Shadab (1975). Due to conservative morphology at the species level most of the descriptive information is in the genus descriptions. Supplementary locality data not provided on original labels are in squared parentheses. To save space, collection method data has been omitted, however the majority of specimens examined were collected in pitfall traps.

Abbreviations

Morphology. *ALE*, anterior lateral eye; *ALS*, anterior lateral spinneret; *BL*, body length; *CL*, carapace length; *Co*, conductor; *CW*, carapace width; *CY*, cylindrical gland spigot; *E*, embolus; *LT*, lateral tooth of epigynum; *MA*, median apophysis; *mAP*, minor ampullate gland spigot; *MAP*, major ampullate gland spigot; *PLE*, posterior lateral eye; *PLS*, posterior lateral spinneret; *PME*, posterior median

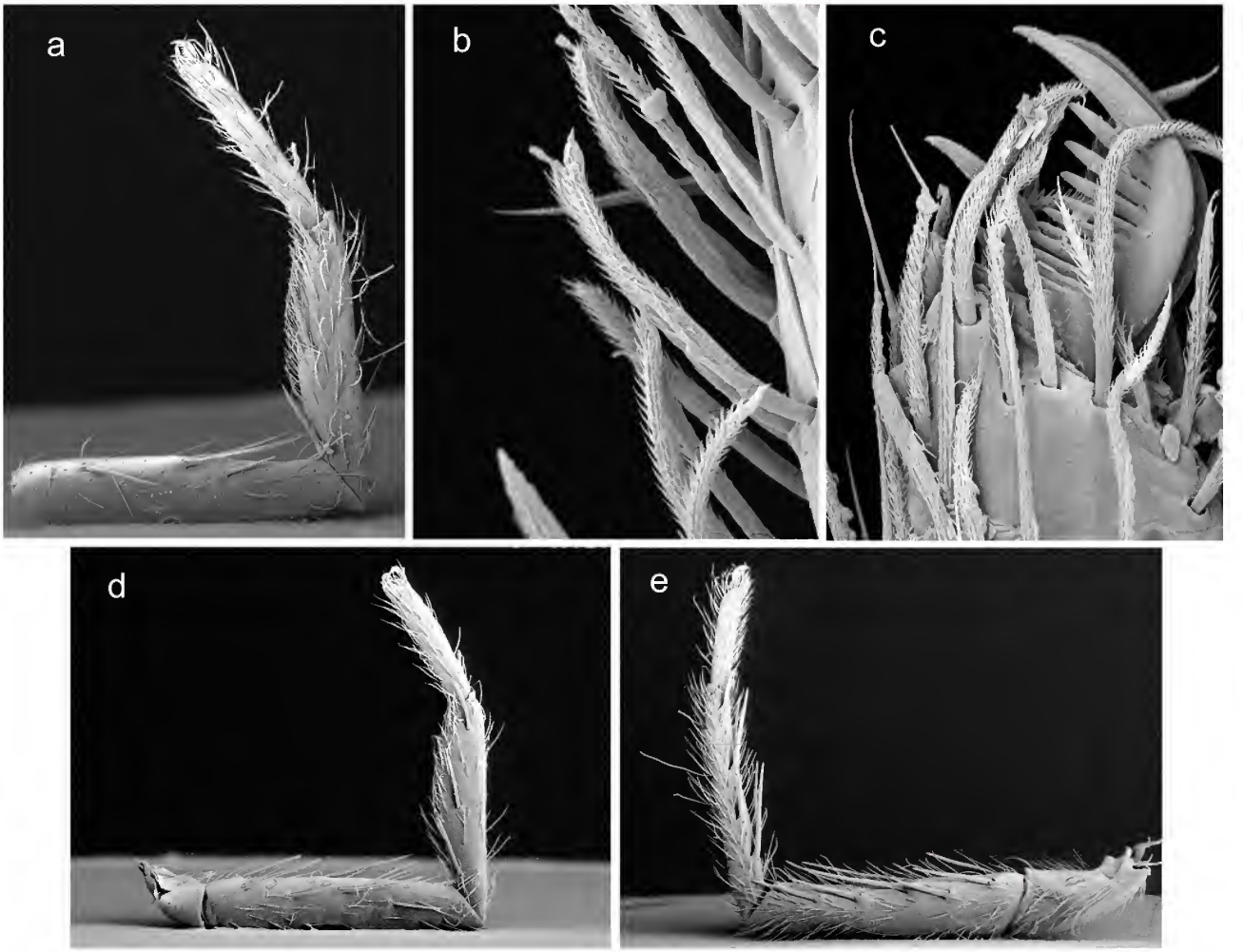

Fig. 4. Forelegs. *(a–c) Oztira aquilonaria* male (S1371): *(a)* left foreleg tibia and tarsal segments, *(b)* ventral scopula on metatarsus, *(c)* tarsal claws. *(d) Oztira affinis* male (KS101138), left foreleg tibia and tarsal segments. *(e) Storenosoma altum* female (KS37226), right foreleg tibia and tarsal segments.

eye; *PMS*, posterior median spinneret; *PP*, proximal process of MA; *RTA*, retrolateral tibial apophysis; *SGO*, sclerotized gonopore opening; *SP*, spermatheca; *TA*, tegular apophysis.

Repository institutions. *AMS*, Australian Museum, Sydney; *ANIC*, Australian National Insect Collection, Canberra; *BMNH*, Natural History Museum, London; *CAS*, California Academy of Sciences, San Francisco; *MNZ*, Museum of New Zealand, Wellington; *NMV*, Museum Victoria, Melbourne; *OM*, Otago Museum, Dunedin; *QM*, Queensland Museum, Brisbane; *SAM*, South Australian Museum, Adelaide; *WAM*, Western Australian Museum, Perth.

Collectors. *CH*, C. Horseman; *GAM*, G.A. Milledge; *GBM*, G.B. Monteith; *GC*, G. Cassis; *MRG*, M.R. Gray; *RC*, R. Coy; *RR*, R. Raven; *SRM*, S.R. Monteith.

Genus *Oztira* n.gen.

Type species. *Oztira affinis* (Hickman, 1981).

Diagnosis. *Oztira* can be distinguished from other amaurobiids except *Otira, Pakeha* and *Storenosoma* by the possession of single or paired stridulatory spines on the trochanter of the male palp (Fig. 3c) and associated stridulatory field on prolateral face of the coxa of leg 1 (Fig. 3d); from *Otira* and *Pakeha* by both eye rows strongly procurved, PLE and to a lesser extent PME enlarged (Fig. 1a–c) and tarsal organ peg-like and situated proximal to trichobothria (Fig. 6); from *Storenosoma* by metatarsus on leg 1 of male swollen distally and with ventral scopula (Fig. 4a–b, d).

Description. Small (CL 1.3–2.3 mm), ecribellate, ground dwelling spiders. Cephalothorax, legs and chelicerae golden to orange brown. Cephalothorax often with darker dorsal markings in radial pattern around fovea, region around eyes very dark. Both eye rows strongly procurved, posterior eyes, particularly PLE, enlarged. Chilum absent. Legs with faint to distinct banding and blotches. Chelicera vertical with prominent retrobasal boss, two retromarginal and two promarginal teeth, promargin also with row of minute teeth distal of and slightly posterior to large teeth. Paturon with numerous sensory hairs toward promargin of fang groove and a particularly elongate hair at fang base; single elongate hair at fang base on retromargin. Maxillae slightly longer than wide, lateral margins convex, with strong linear serrula. Labium about as wide as long, with notched apex. Single or

paired stridulatory spines on the trochanter of the male palp and associated stridulatory field on prolateral face of coxa of leg 1. Cymbium of male palp (Fig. 9) with trichobothria and sometimes with retrolateral bulge and associated basal depression. Complex RTA. Moderately stout embolus, membranous conductor and complex MA, TA well developed. Legs 4123. Trochanters of legs 3–4 shallowly notched. Tibia and metatarsi of legs strongly spinose, tarsal organ rod like and situated proximal to trichobothria, trichobothrial hoods longitudinally striated, metatarsus of leg 1 and sometimes leg 2 of male swollen distally and with ventral scopula, preening combs on metatarsi 2–4. Abdomen pale to grey ventrally, dorsally grey brown with pale blotches forming a rough chevron pattern. Epigynum with or without lateral teeth.

Etymology. The generic name is a combination of the colloquial Oz meaning Australia with a contraction of *Otira* and is feminine in gender.

Remarks. The species described by Hickman (1981) and Davies (1986) were included in *Otira* largely based on the possession of a rod like tarsal organ. However, it appears that this character can be present or absent within members of a single genus e.g., *Storenosoma* (as described herein), *Amauropelma* Raven & Stumkat, 2001 (Raven *et al.*, 2001). Also, the tarsal rod in the Australian species included in this group is proximal to the trichobothria rather than distal as in the New Zealand species. In addition, the form of the eye pattern in *Oztira* more closely resembles that of *Storenosoma* than *Otira* or *Pakeha* (Figs 1a–e). This suggests that *Storenosoma* and *Oztira* are sister groups. The epigyna of many females collected are plugged with a hard, dark resinous substance, making specific identification difficult.

Included species. *Oztira affinis* (Hickman), *Oz. aquilonaria* (Davies), *Oz. kroombiti* n.sp., and *Oz. summa* (Davies).

Key to species of *Oztira*

1 PME of similar diameter to PLE (Fig. 1a), tarsal rod short (Fig. 6a, 6e–f), Tasmania ..... *Oztira affinis*

—— PME about half the diameter of PLE (Fig. 1b) tarsal rod elongate (Fig. 6b–d,g–h), Queensland 2

2 Male with cymbial apophyses (Fig. 11c), female epigynum with lateral teeth, sclerotized gonopore openings separate (Fig. 11d)..... *Oztira kroombiti*

—— Male without cymbial apophyses, female epigynum with or without lateral teeth, sclerotized gonopore openings fused (Figs 10c, 12c) 3

3 Male RTA with one prominent spine (Fig. 10b), female epigynum with blunt lateral teeth, posterior margin of fused sclerotized gonopore openings entire (Fig. 10c) ..... *Oztira aquilonaria*

—— Male RTA with all apophyses short (Fig. 12b), female epigynum without lateral teeth, posterior margin of fused sclerotized gonopore openings incised (Fig. 12c) ..... *Oztira summa*

Oztira affinis (Hickman) new combination

Figs 1a, 4d, 6a,e–f, 9a–d, 26

Otira affinis Hickman, 1981: 62–5, figs 23–28.

Type material examined. HOLOTYPE ♂, Strathgordon, [42°46'S 146°04'E], Tasmania, 16 May 1978, J.L.Hickman, from moss, (AMS KS6995). PARATYPES: 1♀, Same data as holotype (KS6996). 2♀, same data (KS28216).

Other material examined. TASMANIA: 1♂, Maggs Mt, 41°45'S 146°12'E, 13 Jun–19 Sep 1979, R.H. Green (KS101138). 1♀, Pieman Rd., 18 km from Murchison Hwy, 41°37'S 145°27'E, 31 Jan 1981, J.L. Hickman (KS86771). 1♀, South West Tasmania, Gordon River region, HEC transect 11A L490, 42°35'S 145°43'E, 29 Jan 1976, C. Howard *et al.* (KS72948). 1♀, South West Tasmania, HEC transect 1L 150, 42°41'S 145°48'E, 13 Feb 1976, C. Howard *et al.* (KS25701). 1♀, South West Tasmania, HEC transect 7R 2058, 42°51'S 145°51'E, 18 Feb 1976, C. Howard *et al.* (KS26534). 1♀, South West Tasmania, HEC transect 3R 1300, 42°31'S 145°45'E, 19 Jan 1978, C. Howard *et al.* (KS27173). 1♀, South West Tasmania, HEC transect 2L 6750, 42°43'S 145°44'E, 21 Jan 1977, C. Howard *et al.* (KS25684). 1♀, South West Tasmania, HEC transect 1R 1070, 42°41'S 145°49'E, 11 Feb 1976, C. Howard *et al.* (KS26586). 1♀, South West Tasmania, HEC transect 12L 820, 42°55'S 145°53'E, 22 Feb 1977, C. Howard *et al.* (KS26485). 1♀, South West Tasmania, HEC transect 8L 760, 42°37'S 145°45'E, 5 Feb 1976, C. Howard *et al.* (KS26582). 1♀, South West Tasmania, HEC transect 12R 1580, 42°56'S 145°51'E, 19 Feb 1977, C. Howard *et al.* (KS26520). 1♀, South West Tasmania, HEC transect 10L 330, 42°35'S 145°42'E, 31 Jan 1976, C. Howard *et al.* (KS26223). 1♀, South West Tasmania, HEC transect 3R 1225, 42°31'S 145°45'E, 19 Jan 1978, C. Howard *et al.* (KS27124). 1♀, Strathgordon, [42°46'S 146°03'E], 25 Apr 1978, J.L. Hickman (KS28215). 4♀, same data (KS86770). 6♀, same data (KS31781). 2♂, same data except 16 May 1978 (KS28214). 3♀, Track to Heemskirk Falls, 41°50'S 145°11'E, 30 Jan 1981, J.L. Hickman (KS86772). 6♀, Near Tyndalls, [41°56'S 145°34'E], 29 Mar 1975, JAF (KS69912) (all AMS). 1♂, 2♀, Strathgordon, [42°46'S 146°03'E], 25 Apr 1978, J.L. Hickman (S 30779) (QM).

Diagnosis. Both sexes can be separated from other *Oztira* spp. by the short tarsal rod which has a distinct flap like opening (Figs 6a,e–f). Males can also be separated from other *Oztira* spp. by the palpal trochanter having twin stridulatory spines and by the form of the MA and RTA (Fig. 9a–b); females by the epigynum being without lateral teeth and the sclerotized gonopore openings being close together but separate (Fig. 9c–d).

Description. Hickman (1981) gives a full description for this species. A spinal notation from a representative specimen is given here for comparison with *Storenosoma*.

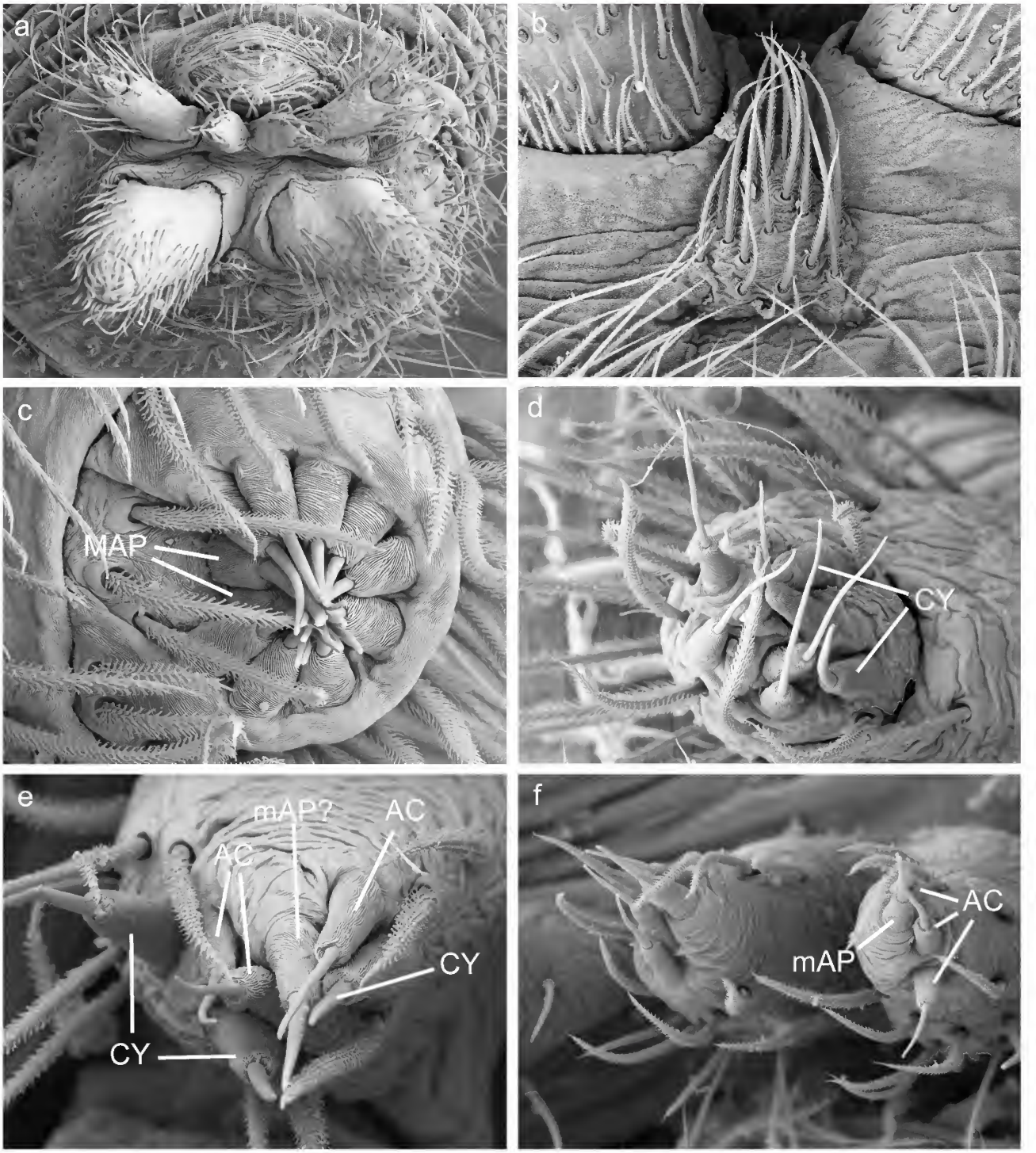

Fig. 5. Spinnerets. *(a–e) Storenosoma hoggi* female (ANIC, NSW, 8.8 km ESE of Captains Flat): *(a)* spinneret field, *(b)* cololus, ventral, *(c)* ALS (RHS), *(d)* PLS (RHS), *(e)* PMS (RHS). *(f) Storenosoma hoggi* male (AMS KS105550) left and right PMS.

Leg spination (only surfaces bearing spines listed, left legs of AMS KS28214): femur: I D 1-1-1; II D 0-2-1; III D 1-1-2; IV D 1-0-3; tibia: I P 2-1-1, R 1-2-0; II P 1-1-1, R 1-1-0; III D 1-0-1, P 2-2-1, R 0-1-2; IV D 1-0-1, P 2-2-1, R 0-1-2; metatarsus; I P 2-2-2, R 2-1-1; II P 1-2-2, R 1-1-1; III D 0-2-0, P 1-2-2, V 2-0-0, R 1-2-2; IV D 0-1-0, P 1-1-2, V 2-2-1, R 1-1-2.

Distribution. Only known from south west Tasmania (Fig. 26).

Oztira aquilonaria (Davies) new combination

Figs 4a–c, 6b, 10a–d, 26

Otira aquilonaria Davies, 1986: 238–40, figs 9–12, 31.

Type material examined. HOLOTYPE ♀, Cable Tower 3, Bellenden Ker Range, [17°12'S 145°51'E], Queensland, 17–24 Oct 1981, Earthwatch/

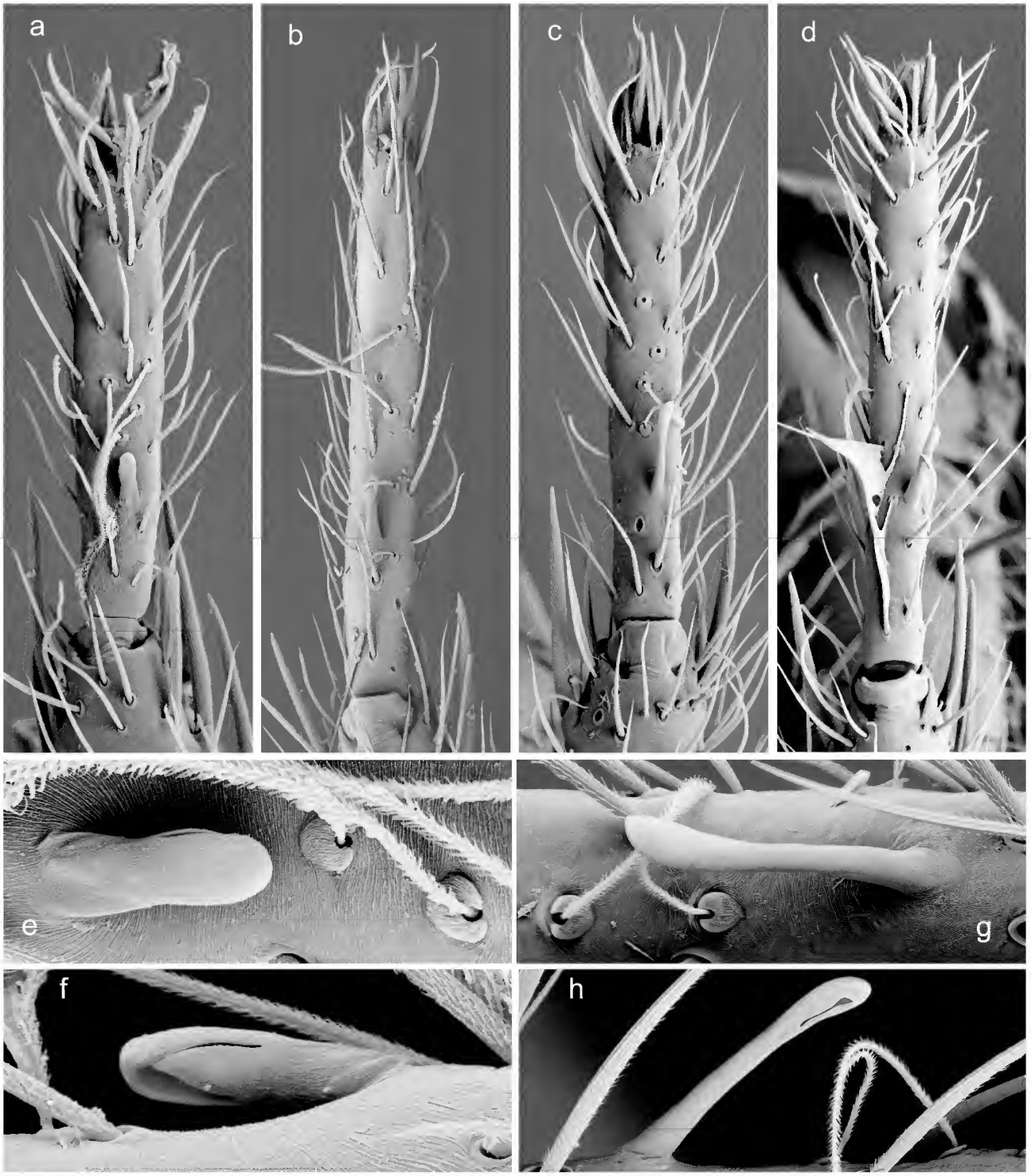

Fig. 6. Tarsal organ and trichobothria. *(a, e–f) Oztira affinis* (KS72948): *(a)* tarsus leg I; *(e)* tarsal organ and trichobothrial base, *(f)* tarsal organ ventral. *(b) Oztira aquilonaria* (S1371): tarsus leg I. *(c, g–h) Oztira kroombit* (S30752): *(c)* tarsus leg I, *(g)* tarsal organ and trichobothrial base, *(h)* tarsal organ ventral. *(d) Oztira summa* (S30776) tarsus leg I.

Queensland Museum Expedition, litter, 1054 m, (S 1368) (QM). PARATYPES: 2♀, same data as holotype (S 1369). 1♂, 1♀, same data except, 25–31 Oct 1981, pitfall traps (S 1371) (all QM).

Diagnosis. Can be separated from *Oz. affinis* by the tarsal rod being elongate with keyhole shaped opening (Fig. 6b), by the male palpal trochanter having a single stridulatory spine and by the female epigynum having blunt lateral teeth (Fig. 10c); from *Oz. kroombit* by the male cymbium lacking apophyses and the gonopore openings on the female epigynum being fused (Fig. 10c–d); from *Oz. summa* by the form of the MA and the RTA, which has a prominent pointed dorsal apophysis, of the male palp (Fig. 10a–b) and by the posterior margin of the fused sclerotized gonopore openings of the female epigynum being entire (Figs 10c–d).

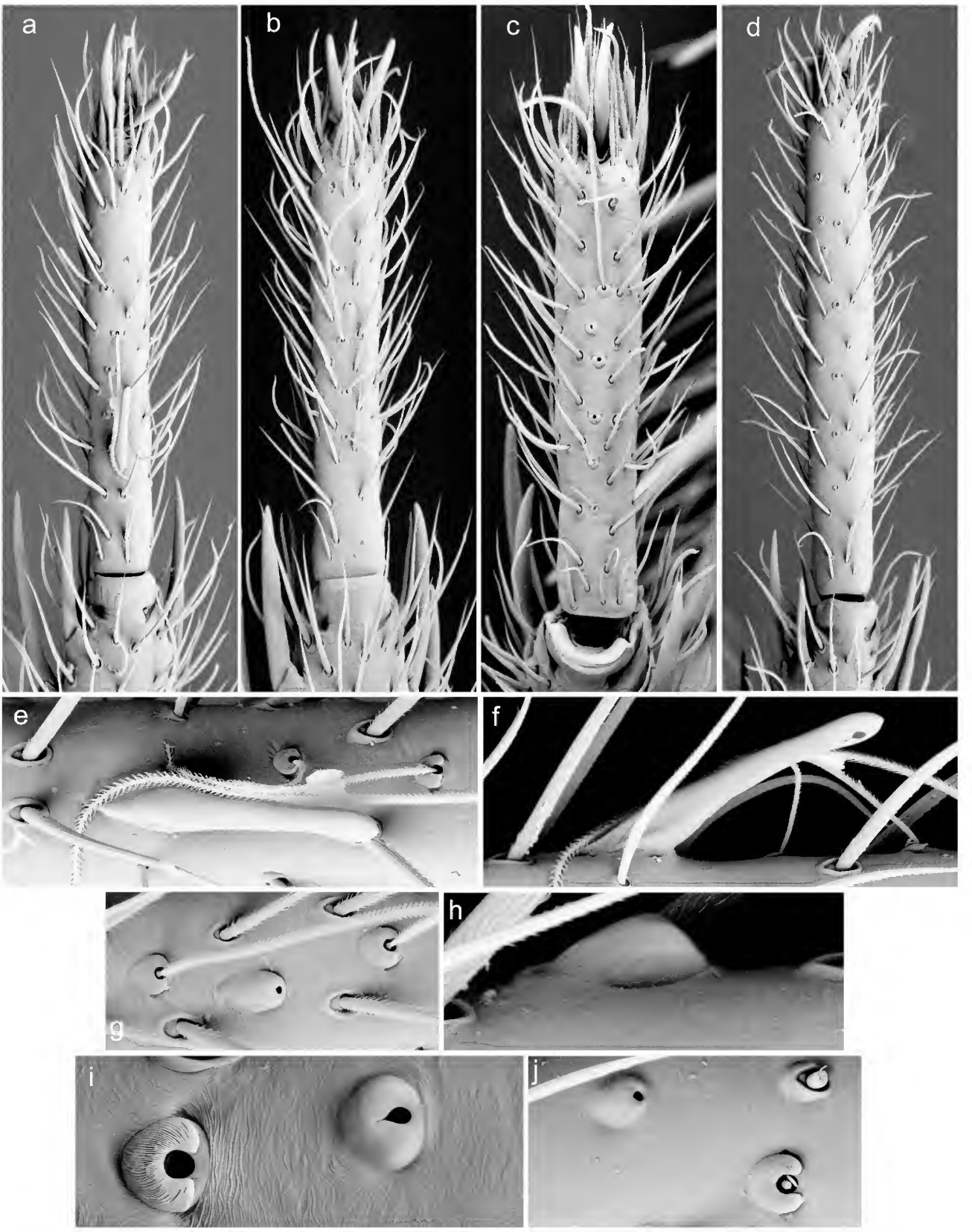

Fig. 7. Tarsal organ and trichobothria. *(a, e–f) Storenosoma grayi* (KS69899): *(a)* tarsus leg I, *(e)* tarsal organ and trichobothrial base, *(f)* tarsal organ ventral. *(b, g–h) Storenosoma altum* (KS37226): *(b)* tarsus leg I, *(g)* tarsal organ and trichobothrial base, *(h)* tarsal organ lateral. *(c, i) Storenosoma hoggi* (K4097): *(c)* tarsus leg I, *(i)* tarsal organ and trichobothrial base. *(d, j) Storenosoma bondi* (KS18071): *(d)* tarsus leg I, *(j)* tarsal organ and trichobothrial base.

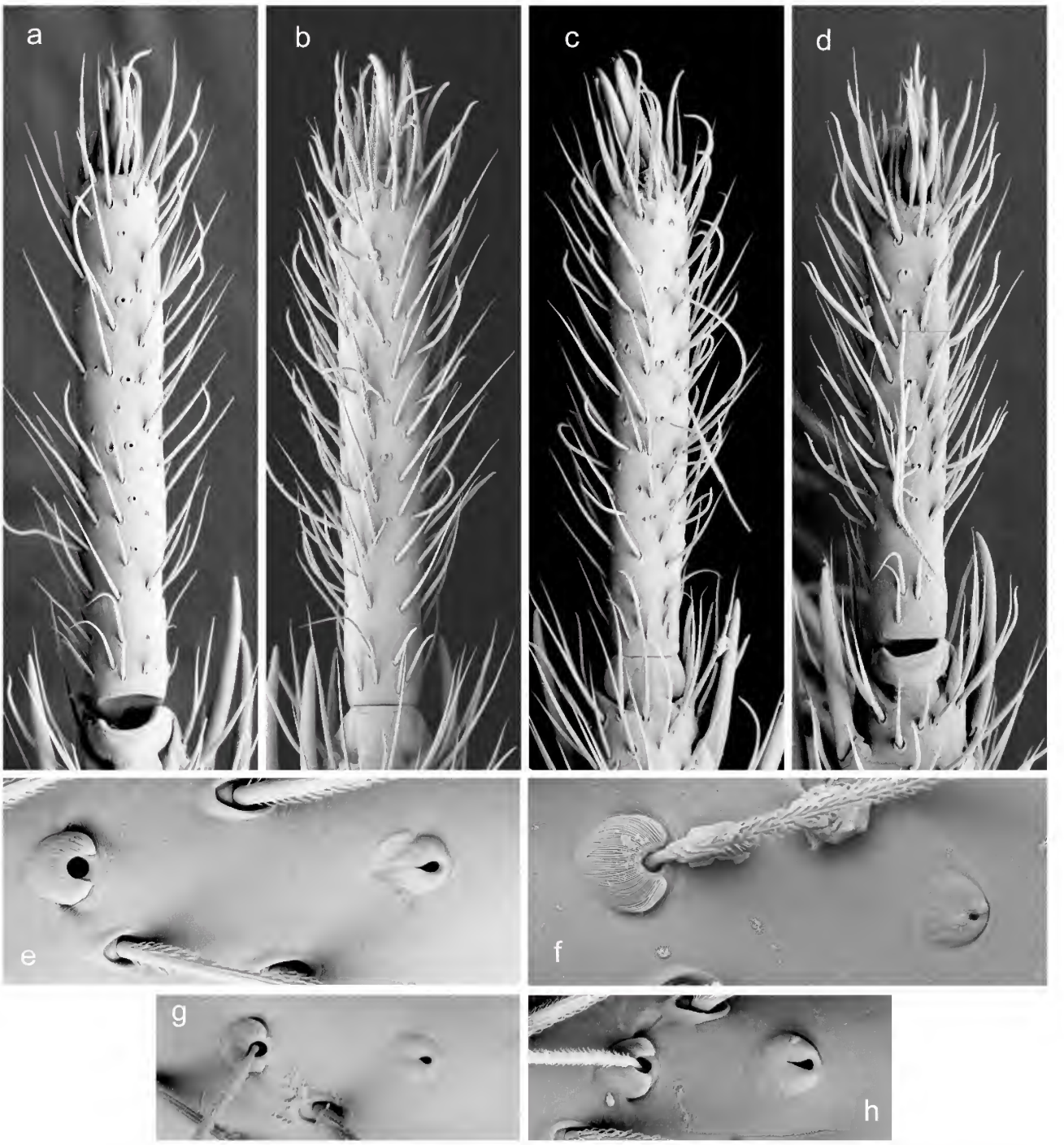

Fig. 8. Tarsal organ and trichobothria. *(a, e) Storenosoma forsteri* (KS52409): *(a)* tarsus leg I, *(e)* tarsal organ and trichobothrial base. *(b, f) Storenosoma smithae* (ANIC, NSW, Mt Clarke, Mar 2004): *(b)* tarsus leg I, *(f)* tarsal organ and trichobothrial base. *(c, g) Storenosoma tasmaniensis* (TMG147): *(c)* tarsus leg I, *(g)* tarsal organ and trichobothrial base. *(d, h) Storenosoma victoria* (K4277): *(d)* tarsus leg I, *(h)* tarsal organ and trichobothrial base.

Description. *Male*. Measurements: BL 3.06, CL 1.70, CW 1.16, PLE 0.21, PME 0.13 (QM, S 1371). *Female*. Measurements: BL 3.84, CL 1.76, CW 1.08, PLE 0.21, PME 0.15 (QM, S 1368). For morphological description see species diagnosis and generic description.

Distribution. Known only from a single locality on Mt Bellenden Ker, north East Queensland (Fig. 26).

Remarks. The right palp of the only known male is illustrated here although the tip of the embolus appears to be broken off. The left palp of this specimen is illustrated in an SEM image by Davies (1986, fig. 31). The view of the RTA illustrated by Davies (1986, fig. 11) is dorsal rather than retrolateral as stated. This species has a very restricted distribution and appears to be sympatric with *Oz. summa*. These two species are quite similar morphologically and probably closely related.

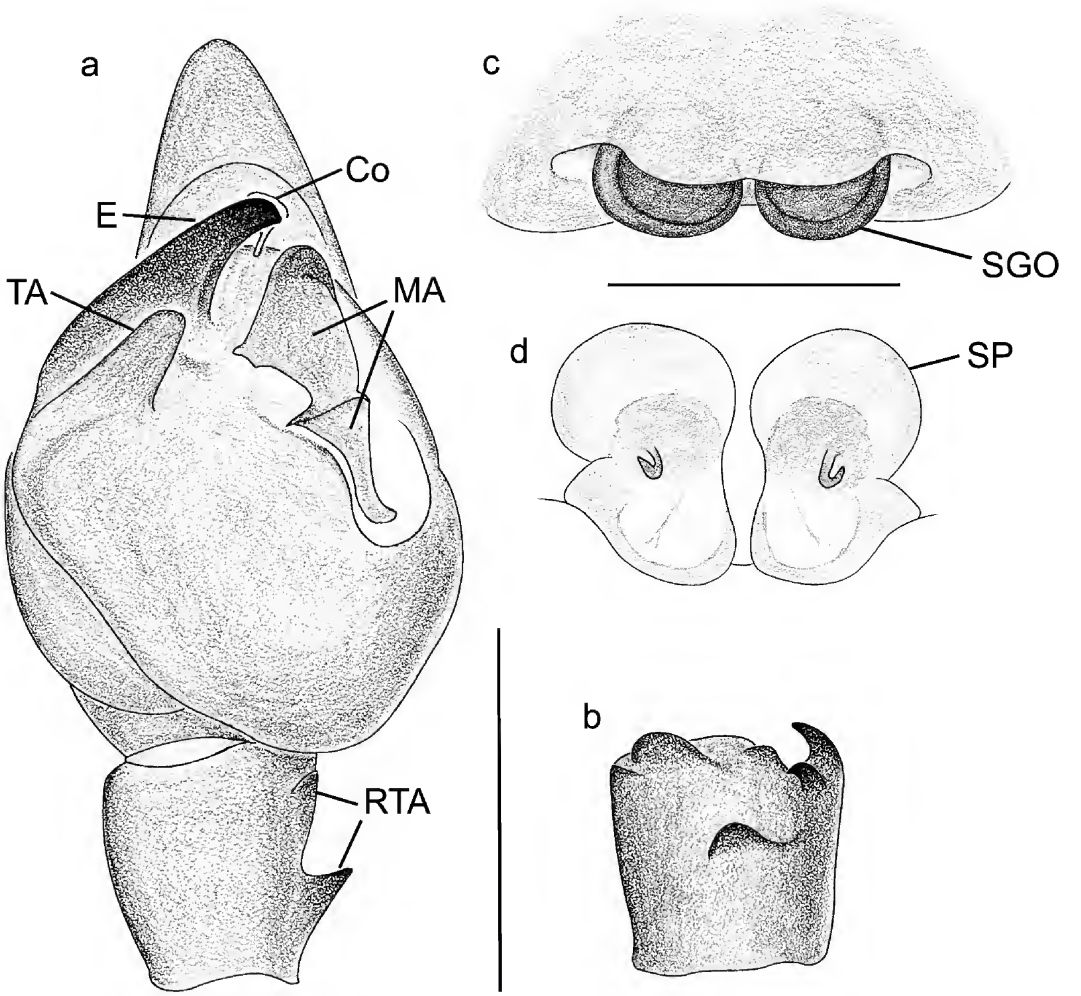

Fig. 9. *Oztira affinis*. *(a–b)* male palp (KS6995): *(a)* ventral, *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (S30779); *(d)* internal (KS28216). Scale lines 0.25 mm.

Oztira kroombit n.sp.

Figs 1b, 6c,g–h, 11a–e, 26

Type material. HOLOTYPE ♂, Kroombit Tops (Beauty Spot 98), 45 km SSW of Calliope, [24°22'S 150°59'E], Queensland, 9–19 Dec 1983, V.E. Davies & J. Gallon, pitfall, rainforest (S 30777) (QM). PARATYPES: 2♀, same data as holotype except (Three Moon Ck) (S 30775). (QM).

Other material examined. QUEENSLAND: 1♂, Kroombit Tops, SSW of Calliope, Beauty Spot 98, 24°22'S 150°59'E, 29 Sep 1985, GBM, 860 m, litter, rainforest (S 46475). 1♀, Kroombit Tops, 45 km SSW of Calliope, 24°24'S 151°01'E, 10 Sep 1983, GBM *et al.*, 890 m, litter, rainforest (S 30778). 2♀, Kroombit Tops, SSW of Calliope, Three Moon Scrub, 24°25'S 151°03'E, 30 Sep 1985, GBM, 940 m, litter, rainforest (S 30752) (all QM).

Diagnosis. Can be separated from *Oz. affinis* by the tarsal rod being elongate with keyhole shaped opening (Fig. 6c,g–h), by the male palpal trochanter having a single stridulatory spine and by the female epigynum having lateral teeth (Fig. 11d); from *Oz. kroombit* and *Oz. summa* by the form of the male MA and RTA (Fig. 11a–b), by the cymbium having basal apophyses (Fig. 11c) and by the gonopore openings on the female epigynum being well separated (Fig. 11d–e).

Description. *Male*. Measurements: BL 3.40, CL 1.80, CW 1.28, PLE 0.25, PME 0.15, (QM, S 30777). *Female*. Measurements: BL 3.84, CL 1.86, CW 1.30, PLE 0.26, PME 0.18, (QM S 30775). For morphological description see species diagnosis and generic description.

Etymology. The specific name is a noun in apposition taken from the type locality.

Distribution. Kroombit Tops area, south east Queensland (Fig. 26).

Oztira summa (Davies) new combination

Figs 6d, 12a–d, 26

Otira summa Davies, 1986: 237–8, figs 2–8, 27–30, 38–39.

Type material examined. HOLOTYPE ♀, Bellenden Ker Range, [17°12'S 145°51'E], Queensland, 1–7 Nov 1981, Earthwatch/Queensland Museum Expedition, litter, mossy microphyll forest, 1560 m, (S 1365) (QM). PARATYPES: 1♂, Same data as holotype except 25–31 Oct 1981 (S 1366). 1♂, same data except 17–24 Oct 1981 (S 1367) (both QM).

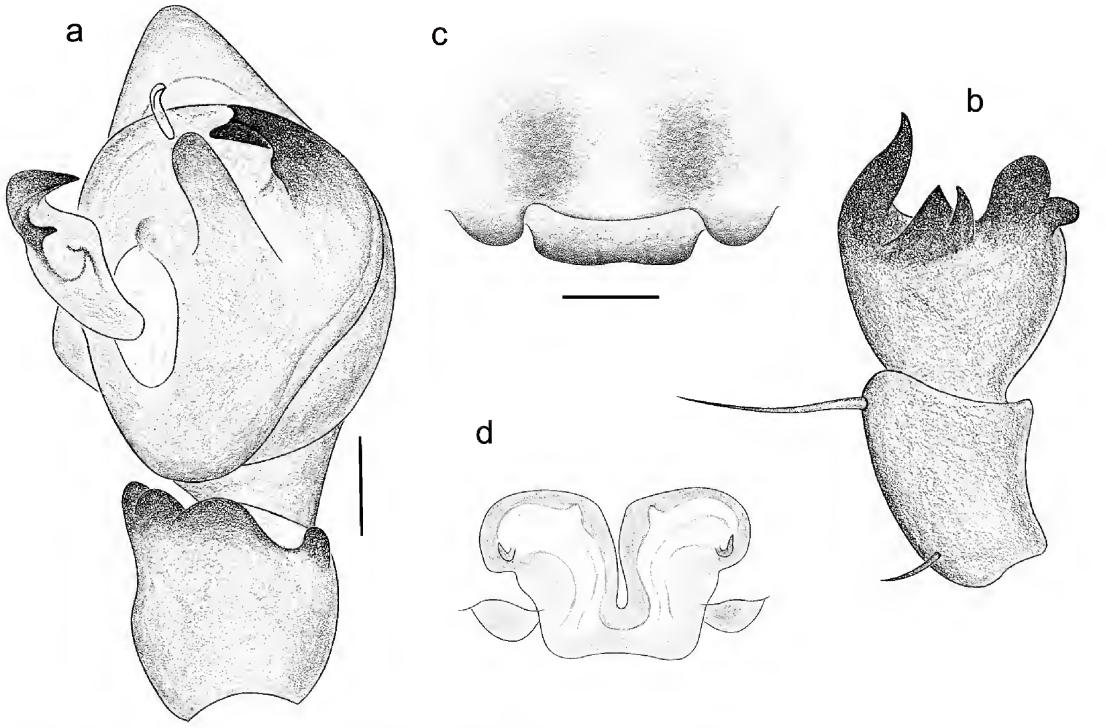

Fig. 10. *Oztira aquilonaria. (a–b)* right male palp (S1371): *(a)* ventral, *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (S1371); *(d)* internal (S1377). Scale lines 0.1 mm.

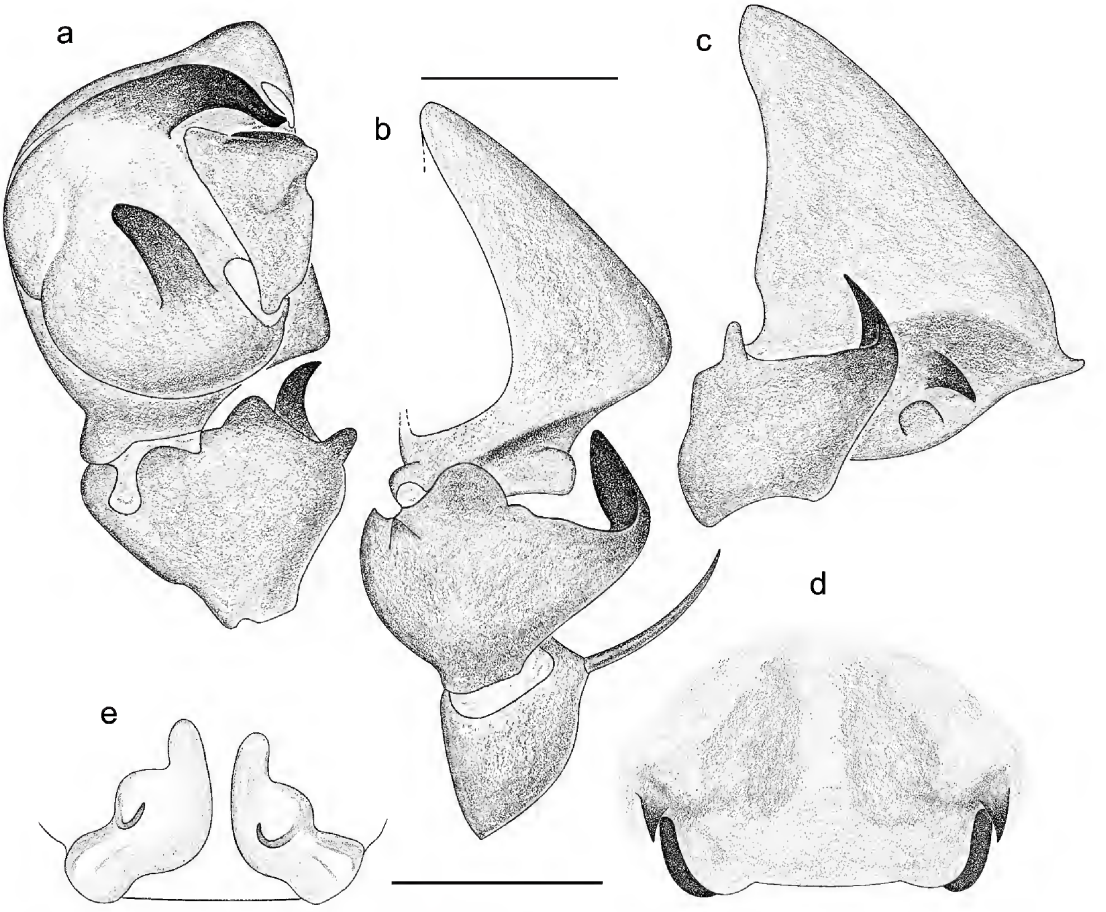

Fig. 11. *Oztira kroombit. (a–c)* male palp (S30777): *(a)* ventral; *(b)* RTA, retrolateral; cymbium and RTA, dorsolateral. *(d–e)* female genitalia: *(d)* epigynum, ventral (S30752); *(e)* internal (S30778). Scale lines 0.25 mm.

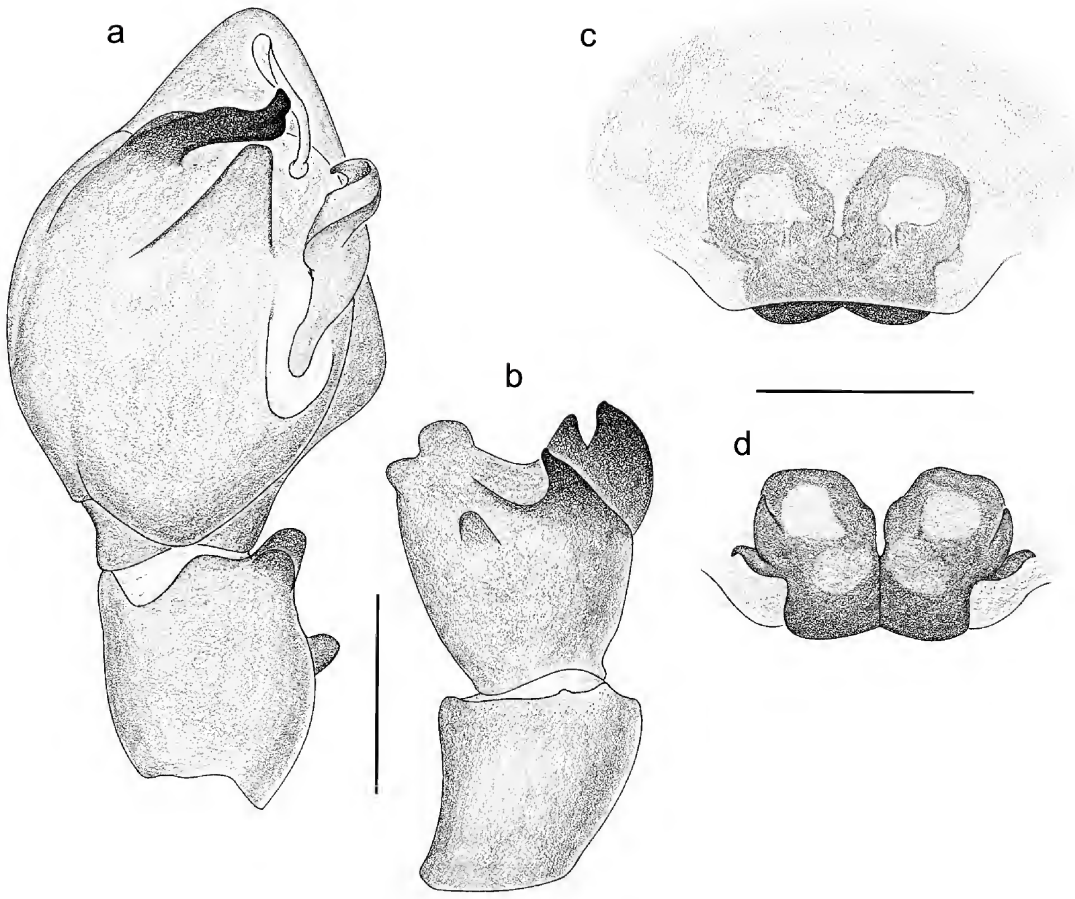

Fig. 12. *Oztira summa. (a–b)* male palp (S20783): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (S1365): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

Other material examined. QUEENSLAND: 1♂, Bellenden Ker summit, 17°16'S 145°52'E, 28 Aug–8 Oct 1991, GBM & Janetzki (S20783). 1♀, Bellenden Ker Range Summit TV Stn., Oct–Dec 1982, 1560 m, S. Montague, rainforest (S 30776) (both QM).

Diagnosis. Can be separated from *Oz. affinis* by the tarsal rod being elongate with keyhole shaped opening (Fig. 6d and Davies, 1986; figs 28 & 38), by the male palpal trochanter having a single stridulatory spine and by the female epigynum having fused gonopore openings (Fig. 12c–d); from *Oz. kroombit* by the male cymbium lacking apophyses and the gonopore openings on the female epigynum being fused (Fig. 12c–d); from *Oz. aquilonaria* by the form of the MA and RTA, which lacks a prominent pointed dorsal apophysis, of the male palp (Fig. 12a–b) and by the posterior margin of the fused sclerotized gonopore openings of the female epigynum being incised (Fig. 12c).

Description. *Male*. Measurements: BL 4.0, CL 2.25, CW 1.50, PLE 0.27, PME 0.15 (QM, S 1366). *Female*. Measurements: BL 4.25, CL 2.25, CW 1.40, PLE 0.30, PME 0.17 (QM, S1365). For morphological description see species diagnosis and generic description.

Distribution. Known only from the summit of Mt Bellenden Ker in North East Queensland. (Fig. 26).

Remarks. The view of the RTA illustrated by Davies (1986, fig. 7) is dorsal rather than retrolateral as stated.

Genus *Storenosoma* Hogg

Storenosoma Hogg, 1900: 95. Type species: *Storenosoma hoggi* (Roewer, 1942).

Diagnosis. *Storenosoma* can be distinguished from other amaurobiids except *Otira, Oztira* and *Pakeha* by the possession of paired stridulatory spines on the trochanter of the male palp (Fig. 3c) and associated stridulatory field on prolateral face of the coxa of leg 1 (Fig. 3d); from *Otira* and *Pakeha* by both eye rows strongly procurved, PLE and to a lesser extent PME enlarged (Fig. 1a–c) and tarsal organ capsulate or, if peg-like, being situated proximal to trichobothria (Figs 7–8); from *Oztira* by metatarsus on leg 1 of male being cylindrical (Fig. 4e).

Description. Medium sized (CL 3.0–5.6), ecribellate, ground dwelling spiders. Cephalothorax, legs and chelicerae golden to orange brown. Cephalothorax often with darker dorsal markings in radial pattern around fovea, region around eyes very dark, chilum absent. Both eye rows strongly procurved, posterior eyes, particularly PLE, enlarged. ALE with canoe shaped tapetum, PME with flocculent reflective layer and PLE with diffuse reflective layer (pers obs). Chelicera vertical with prominent retrobasal boss, two retromarginal and two promarginal teeth, promargin also with row of minute teeth distal and slightly posterior to large teeth (Fig. 3a). Paturon with numerous sensory hairs toward promargin of fang groove and a particularly elongate hair at fang base,

single elongate hair at fang base on retromargin. Maxillae slightly longer than wide, lateral margins convex, with strong linear serrula. Labium about as wide as long, with notched apex. Paired stridulatory spines on the trochanter of the male palp and associated stridulatory field on prolateral face of coxa 1. Cymbium of male palp with trichobothria (Fig. 3b) and retrolateral bulge associated with basal depression (Figs 2c,d). Complex RTA. Stout, blunt to pointy tipped embolus, membranous conductor, complex MA often with proximal or prolateral processes, TA well developed to absent. Legs with dark banding and blotches. Legs 4123. Trochanters of legs 3–4 shallowly notched. Tibia and metatarsi of legs strongly spinose, tarsal organ capsulate or rod like, trichobothrial hoods longitudinally striated, preening combs on metatarsi 2–4 (Fig. 3e). Abdomen grey brown, flecked with darker and lighter spots, sometimes with paired, dark coloured chevrons in distal half. Epigynum with lateral teeth and distinctly sclerotized gonopore openings, spermathecae and copulatory ducts simple.

Remarks. The species are all quite similar in appearance and can only be confidently separated on the basis of genital morphology. Only male characters are used in the key as females are not known for all species, the genitalia of the known species are fairly conservative and, similar to *Oztira*, the epigyna of most females collected are plugged with a hard, dark resinous substance which obscures external and to some extent internal characters, making specific identification difficult. This substance is extremely tough and is deposited both internally and externally on the epigynum. The author was unable to remove it mechanically or chemically using bleach solution or potassium hydroxide solution. This plug is most likely produced by the male in a similar fashion to that of *Amaurobius* C.L. Koch 1837 (Suhm *et al.*, 1996) and also noted by Davies (2003) in *Tangana* Davies, 2003. Forster & Wilton (1973) also noted mating plugs in *Pakeha minima* Forster & Wilton, 1973. Whether these plugs completely preclude further matings is debatable. Eberhard (1985) argues that female mate selection is the driving force behind interspecific differences in male genitalia and for it to operate multiple matings must occur. However, as in *Amaurobius*, the mating plug in *Storenosoma* is very tough and it is difficult to envisage it being removed by mechanical means. It seems likely that the "lateral epigynal protuberances" described by Davies (1998) for *Tasmarubrius* Davies, 1998 are similar mating plugs. Davies (2002) also mentions plugs in the epigyna of some specimens of *Tasmabrochus cranstoni* Davies, 2002. Also notable is the variation in the tarsal organ within this genus. Most species have the tarsal organ capsulate and distal to the trichobothria. In three species it is situated between the first and second trichobothrium and in one of these it is raised somewhat. One species has a rod like tarsal organ situated proximal to the trichobothria, similar to *Oztira*.

Included species. *Storenosoma altum* Davies, *S. bifidum* n.sp., *S. bondi* n.sp., *S. forsteri* n.sp., *S. grayi* n.sp., *S. hoggi* (Roewer), *S. grossum* n.sp., *S. picadilly* n.sp., *S. smithae* n.sp., *S. supernum* Davies, *S. tasmaniensis* n.sp., *S. terraneum* Davies and *S. victoria* n.sp.

Key to males of *Storenosoma* species

1 Tarsal organ rod shaped (Figs 7a,e–f) ..... *S. grayi*
—— Tarsal organ capsulate 2

2 Cymbium of palp with basal swelling topped by 2–4 stout macrosetae (Fig. 24a) .... *S. terraneum*
—— Cymbium of palp without basal swelling, with or without basal macrosetae 3

3 Cymbium of palp with 2–3 basal macrosetae (Fig. 25b) ..... *S. victoria*
—— Cymbium of palp without basal macrosetae 4

4 Embolus with distinctly bifid tip (Fig. 14a) ..... *S. bifidum*
—— Embolus tip not distinctly bifid 5

5 MA with distinct proximal projection (Figs 13a, 15a, 19a) 6
—— MA with short or indistinct proximal projection (Figs 18a, 21a, 24a) 10

6 Proximal projection of MA curved prolaterally (Figs 13a, 16a, 20a) 7
—— Proximal projection of MA not curved prolaterally (Figs 15a, 19a) 9

7 TA obvious (Fig. 13a, 20a) 8
—— TA hardly apparent (Fig. 16a) ..... *S. forsteri*

8 TA single (Fig. 13a) ..... *S. altum*
—— TA double (Fig. 20a) ..... *S. picadilly*

9 TA large with broad, rounded tip (Fig. 19a) ..... *S. hoggi*
—— TA smaller, triangular, with pointed tip (Fig. 15a) ..... *S. bondi*

10 Embolar base with lobe (Figs 2a,b, 22a, 23a) 12
—— Embolar base without lobe (Figs 18a, 21a) 11

11 RTA with prominent basal projection (Fig. 21b) ..... *S. smithae*
—— RTA without prominent basal projection (Fig. 18b) ..... *S. grossum*

12 MA oblong (Fig. 22a). TA absent ..... *S. supernum*
—— MA bean-shaped (Fig. 23a). TA present ..... *S. tasmaniensis*

Storenosoma altum Davies

Figs 4e, 7b,g–h, 13a–d, 27b

Storenosoma alta Davies, 1986: 242, figs 24–26, 37.

Type material examined. HOLOTYPE ♀, Poverty Point, near Tenterfield, 1160 m, 29°08'S 152°17'E, New South Wales, 2 Oct 1978–21 Feb 1979, G.B. Monteith, pitfall trap, (S 1383) (QM). PARATYPES: 1♂, same data as holotype (S 1384). 1♀, same data (S 1385) (both QM).

Other material examined. QUEENSLAND: 1♀, Binna Burra, [28°12'S 153°11'E], Lamington National Park, 28 Mar 1976, RR & V. Davies (S 30755) (QM). 1♀, Cunningham's Gap, [28°03'S 152°24'E], Main Range National Park, 28 Jun 1991, D. Black (95/1190) (WAM).

NEW SOUTH WALES: 4♂, Banda Banda Beech Reserve, Mt Boss State Forest, NW of Wauchope, 31°10'S 152°26'E, Oct 1980, G. Webb (KS42830). 2♀, Banda Banda Flora Reserve, Banda Rd, 3 km E of Hastings Forest Hwy, 31°09'S 152°24'E, 4 Feb–9 Apr 1993, MRG & GC (KS42537). 7♀, same data (KS42538). 1♀, same data (KS42539). 2♂, Barrington Tops NP, Gloucester Tops Rd, 32°03'45"S 151°36'02"E, 13 Nov–19 Dec 2007, GAM & H. Smith (KS102949). 1♀, same data (KS102973). 1♂, Barrington Tops NP, Quarry Rd turnoff, 31°54'45"S 151°31'10"E, 30 Apr 2008, GAM & A. Hegedus (KS105023). 1♂, same data except 18 Mar–30 Apr 2008 (KS103917). 4♂, 2♀, same data except 14 Nov–18 Dec 2007, GAM & H. Smith (KS104654). 3♂, 1♀, same data (KS104642). 1♀, Barrington Tops SF, 0.8 km E of Moppy Picnic Area, 31°53'22"S 151°33'57"E, 14 Nov–18 Dec 2007, GAM & H. Smith (KS104665). 1♀, same data except 18 Mar–30 Apr 2008, GAM & A. Hegedus (KS103896). 1♀, same data except 18 Dec 2007–31 Jan 2008 (KS102091). 1♂, Barrington Tops Reserve, Nth Branch Rd, 31°52'41"S 151°29'32"E, 18 Mar–30 Apr 2008, GAM & A. Hegedus (KS103933). 1♀, same data except 31 Jan–18 Mar 2008 (KS103359). 2♀, 19.5 km NW of Bellingen, Dorrigo-Bellingen Rd, 30°24'S 152°44'E, 18 Feb 1993, MG & GC (KS35276). 1♀, Beaury State Forest, Bennetts Rd, 10 km NW of Urbenville, 28°25'S 152°27'E, 4 Feb–9 Apr 1993, MRG & GC (KS36080). 13♂, 2♀, Mt Boss State Forest (Cock), 31°12'S 152°24'E, Oct 1980, G.Webb (KS42843). 1♂, same data except (Blue) (KS42846). 1♂, same data except (Kota) (KS69890). 1♀, same data except (Valley) (KS69888). 19♂, 2♀, same data except (Fenwicks) (KS43512). 17♂, 2♀, same data except (Thumb) (KS43534). 2♂, 1♀, same data except (Sth Plateau) (KS69889). 2♀, Mt Boss State Forest, North Plateau Rd, 3.5 km from Plateau Beach Picnic Area, 31°11'S 152°20'E, 4 Feb–9 Apr 1993, MRG & GC (KS42536). 2♀, same data except 1.5 km (KS42546). 1♀, Mt Boss State Forest, Rimau Rd, 13.8 km E of Cockerawombeeba Rd, 31°11'S 152°22'E, 4 Feb–9 Apr 1993, MRG & GC (KS42540). 1♀, Carrai Bat Cave, near Carrai, 31°01'S 152°20'E, 26 Apr 1974, MRG (KS44939). 1♀, Carrai State Forest, Fife's Knob Rd, 30°54'S 152°22'E, 4 Feb–9 Apr 1993, MRG & GC (KS41331). 2♂, Chichester State Forest, 0.1 km N of Trig Tower, 32°06'S 151°45'E, 4 Feb–9 Apr 1993, MRG & GC (KS42530). 1♀, same data (KS42528). 1♀, same data (KS42529). 1♀, Chichester State Forest, Mt Allyn Rd, adjacent to Mt Allyn Forest Park, 32°07'S 151°25'E, 4 Feb–9 Apr 1993, MRG & GC (KS41365). 1♀, Chichester State Forest, Lumeah Rd, 1.7 km from Mt Allyn Rd, 32°06'S 151°26'E, 4 Feb–9 Apr 1993, MRG & GC (KS41370). 3♀, Chichester State Forest, Berrico Rd, 2 km S of Kunungra Rd junction, 32°05'S 151°45'E, 4 Feb–9 Apr 1993, MRG & GC (KS41375). 3♀, Chichester State Forest, Kunungra & Berrico Rds intersection, 32°06'S 151°46'E, 4 Feb–9 Apr 1993, MRG & GC (KS41376). 3♂, 11♀, Dorrigo National Park, Dome Rd, 2 km W of Never Never Picnic Area, 30°21'S 152°47'E, 4 Feb–9 Apr 1993, MRG & GC (KS35262). 5♀, Dorrigo National Park, Wonga Walk, 0.2 km SW of Hardwood Lookout, 30°22'S 152°54'E, 4 Feb–9 Apr 1993, MRG & GC (KS35265). 1♂, Enfield State Forest, Mummel Forest Road, 6.1 km N of junction with Enfield Rd, 31°17'S 151°51'E, 4 Feb–9 Apr 1993, MRG & GC (KS40814). 2♀, same data (69892). 2♀, same data except 7.6 km N (KS69893). 2♀, Ewingar State Forest, tributary of Grasstree Creek, Nogrigar Rd, 29°08'S 152°25'E, 4 Feb–9 Apr 1993, MRG & GC (KS42523). 1♀, Ewingar State Forest,

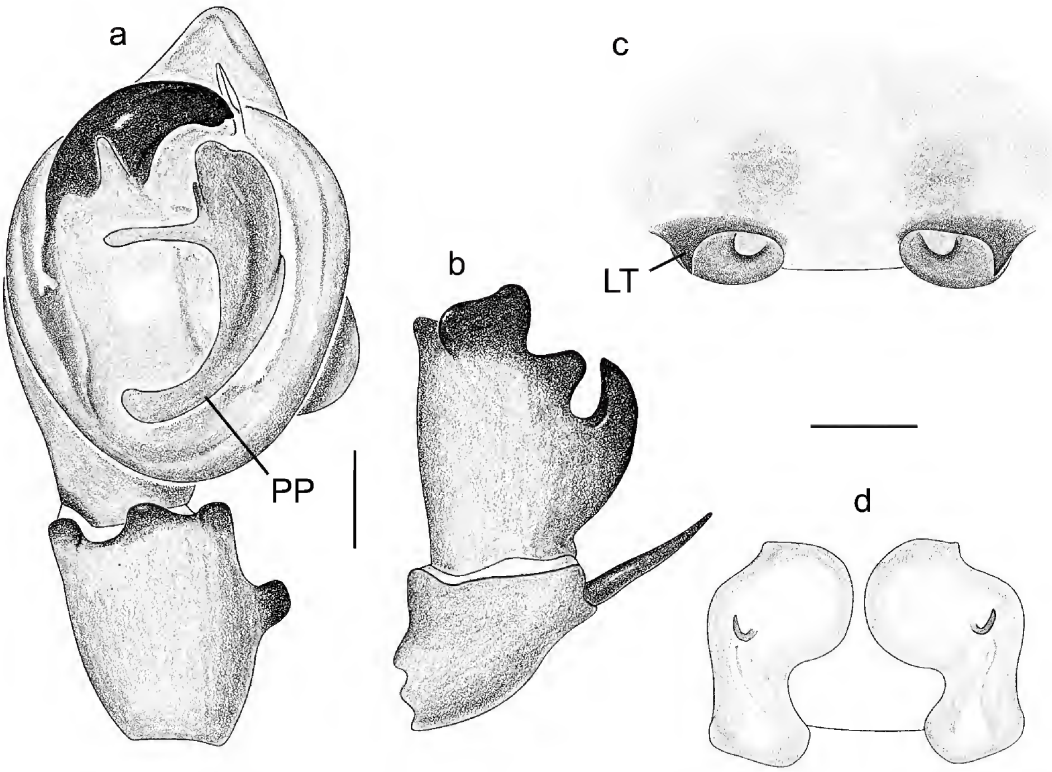

Fig. 13. *Storenosoma altum. (a–b)* male palp (KS42843): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (KS42548); *(d)* internal (KS42549). Scale lines 0.25 mm.

North Ewingar Rd, 29°08'S 152°25'E, MRG & GC (KS42522). 1♀, above Kunderang Station Creek, northeast facing slope, 30°48'S 152°06'E, 4 Feb–9 Apr 1993, MRG & GC (KS40817). 3♀, London Bridge State Forest, 2.7 km SW of London Bridge, 29°51'S 152°13'E, 4 Feb–9 Apr 1993, MRG & GC (KS37252). 2♀, Mt Lumeah, west flank, Chichester State Forest, near Dungong, 32°06'S 151°11'E, Jan 1976, MRG (KS1425). 1f, on Mountain Rd, 0.2 km S of junction with Kunungra Rd, 32°08'S 151°44'E, 4 Feb–9 Apr 1993, MRG & GC (KS42525). 1♀, New England National Park, Cliffs Trail, 2 km S of Point Lookout Rd gate, 30°30'S 152°23'E, 4 Feb–9 Apr 1993, MRG & GC (KS35286). 3♀, Ramornie State Forest, Mt Tindal Rd, 29°41'S 152°35'E, 4 Feb–9 Apr 1993, MRG & GC (KS40950). 1♀, same data (KS40951). 3♀, same data (KS40952). 1♀, Stewarts Brook State Forest, Bull Gully, near junction of Bull Gully & Bull Ridge Rds, 31°57'S 151°22'E, 4 Feb–9 Apr 1993, MRG & GC (KS42521). 1♀, Stewarts Brook SF, Polblue Ridge Rd, 31°56'59"S 151°23'40"E, 18 Mar–30 Apr 2008, GAM & A. Hegedus (KS103953). 1♀, same data except 18 Dec 2007–31 Jan 2008 (KS102091). 1♀, Stydgy Creek headwater, leasehold land, 28°45'S 152°17'E, 18 Feb 1992, MRG & GC (KS37206). 1♀, Styx River State Forest, bottom end of Cliffs Trail, 1.3 km from Oxley Rd, 30°33'S 152°20'E, 4 Feb–9 Apr 1993, MRG & GC (KS35287). 1♀, same data except 2.8 km from Oxley Rd, 30°33'S 152°21'E (KS35292). 3♀, same data except 3.8 km NE of Oxley Rd (KS35293). 1♀, Styx River State Forest, off Cunawarra Trail, 30°32'S 152°20'E, 4 Feb–9 Apr 1993, MRG & GC (KS35298). 1♂, Washpool National Park, track off Cedar Trail, 29°28'S 152°20'E, 4 Feb–9 Apr 1993, MRG & GC (KS37230). 4♀, same data (KS37226). 4♀, same data (KS37234). 3♂, Washpool State Forest, Area 17, Series C, midslope, 29°16'S 152°22'E, 9 Mar 1992, MRG & P.Croft (KS38014). 2♂, same data (KS38015). 1♂, same data (KS38017). 1♂, same data (KS38018). 2♂, same data (KS38019). 1♀, same data (KS38020). 1♀, same data (KS38021). 1♀, same data (KS38022) (all AMS). 2♂, Banksia Pt., New England NP, 30°29'S 152°24'E, 2–15 Oct 1984, Naumann & Cardale. 1♀, Dorrigo NP, 30°22'S 152°45'E, 2–15 Oct 1984, Naumann & Cardale. 12♂, Tom's Cabin, New England NP, 30°30'S 151°34'E, 2–15 Oct 1984, Naumann & Cardale (all ANIC). 3♀, Never Never, Dorrigo, [30°22'S 152°51'E], 12 Nov 1980–16 Mar 1981, GBM (S 30745). 1♀, same data (S 30746). 1♀, same data except 22 Mar–12 Nov 1980 (S 30759). 1♂, 1♀, same data (S 30751). 1♀, New England National Park, 22 Mar 1980, GBM (S 30757). 1♂, 1♀, Point Lookout Lower, New England National Park, 22 Mar–2 Nov 1980, GBM (S 30754). 1♀, Point Lookout Upper, New England National Park, 11 Nov 1980–16 Mar 1981, GBM (S 30749). 3♀, same data except 21 Mar–2 Nov 1980 (S 30742). 1♀, Poverty Point (creek), [29°08'S 152°17'E], via Tenterfield, 2 Oct 1978–21 Feb 1979, GBM (S 30747). 4♂, 3♀, West Gibraltar, 31 Mar–11 Nov 1980 GBM (S 30787). 2♂, 1♀, same data (S 30741). 1♂, 2♀, Poverty Point, 1160 m, [29°08'S 152°17'E], 27 May–3 Oct 1978, GBM (S 30743) (all QM).

Diagnosis. Male palp (Figs 13a–b) with well-developed, narrow TA. MA with elongate, prolaterally curved proximal projection and slender prolateral projection. Palpal patella with one, stout dorsal spine, palpal tibia with single slender dorsal spine. Female epigynum with strong lateral teeth (Fig. 13c). Tarsal organ capsulate (Fig. 7g–h), situated between trichobothria 1 and 2, slightly raised.

Description. *Male*. Measurements: BL 6.25, CL 3.50, CW 2.75, PLE 0.33, PME 0.23 (QM, S1384). *Female*. Measurements: BL 7.85, CL 3.60, CW 2.64, PLE 0.35, PME 0.22 (QM, S1383). For morphological description see species diagnosis and generic description.

Distribution. North eastern New South Wales and south eastern Queensland (Fig. 27b).

Remarks. The female holotype has the epigynum plugged.

Storenosoma bifidum n.sp.

Figs 14a–d, 27c

Type material. HOLOTYPE ♂, 10.4 km NW of Toorongo, 37°44'S 146°01'E, DCE Upper Yarra site 2, 14–24 Nov 1988, L. Lumsden (K 10768) (NMV). PARATYPES, 24♂, same data as holotype (K 3994). 1♂, same data (K 3993). 1♂, same data (K 3992). 2♀, same data (K 4039) (all NMV).

Other material examined. VICTORIA: 1♀, Mt Worth State Park, near Seaview, 38°16'S 145°59'E, 23 Mar 1978, MRG (KS45281) (AMS). 1♂, Otway Ranges, Phillips Track, 0.5 km N of Triplet Falls, 38°40'S 143°29'E, 31 Jan to 11 Apr 1995, GAM (K 4027). 1♂, Otway Ranges, Young Creek Rd, 0.4 km NW of Triplet Falls, 38°40'S 143°29'E, 6 Sep to 15 Nov 1994, GAM

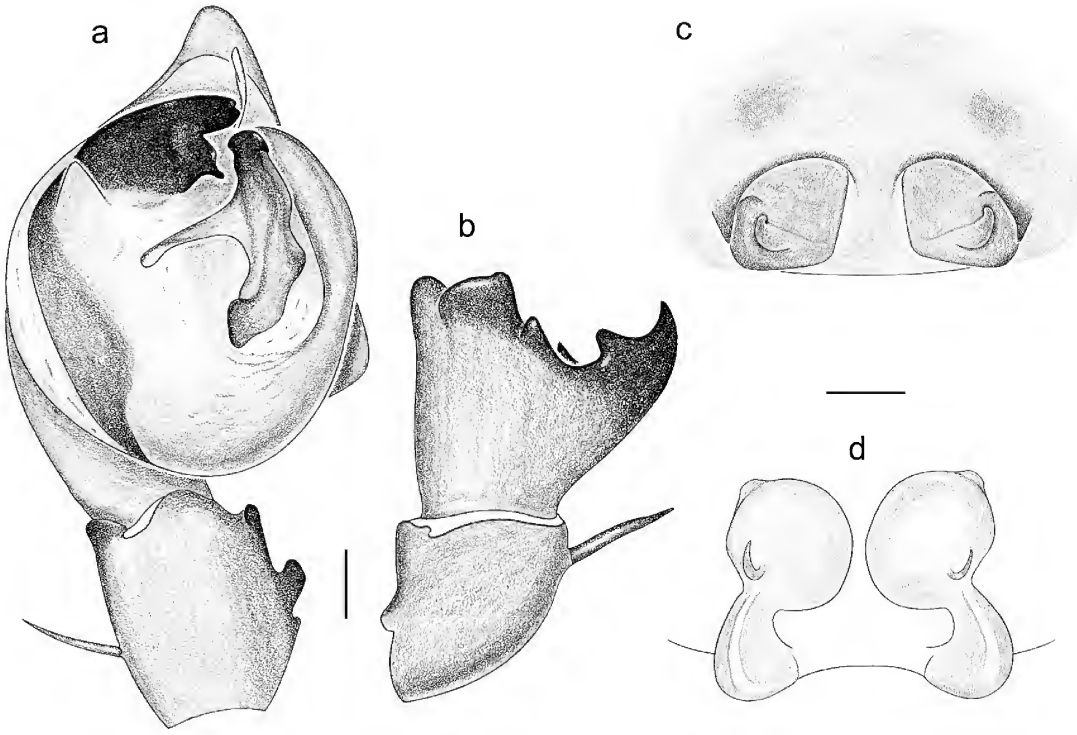

Fig. 14. *Storenosoma bifidum*. *(a–b)* male palp (K3994): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (K4113): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

(K 4025). 1♂, Otway Ranges, Young Creek Rd, 0.2 km NE of Ciancio Creek crossing, 38°42'S 143°29'E, 15 Nov 1994 to 31 Jan 1995, GAM (K 4026). 3♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, 0.5 km NNE of Tarra Valley Picnic Area, 38°26'40"S 146°32'30"E, 14 Nov 1995 to 10 Jan 1996, GAM (K 4029). 2♂, same data (K 4028). 1♀, same data (K 4113). 1♀, same data except 5 Mar–7 May 1996 (K 4030). 2♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, 0.2 km W of Tarra Valley Picnic Area, 38°27'S 146°32'E, 14 Sep to 14 Nov 1995, GAM (K 4031). 3♂, same data except 14 Nov 1995–10 Jan 1996 (K 4032). 1♀, same data except 5 Mar–7 May 1996 (K 4033). 1♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, Bulga Picnic Area, 38°25'30"S 146°34'20"E, 14 Sep to 14 Nov 1995, GAM (K 4034). 2♂, same data except 14 Nov 1995 to 10 Jan 1996 (K 4035). 1♂, Strzelecki Ranges, Gunyah-Toora Rd, 2 km SSW of Gunyah Gunyah, 38°32'30"S 146°19'E, 14 Sep to 14 Nov 1995, GAM (K 4036). 4♂, same data except 14 Nov 1995 to 10 Jan 1996 (K 4037). 1♂, Sherbrooke Forest, Aug 1974 (K 4038) (all NMV).

Diagnosis. Male palp (Figs 14a–b) with short, triangular TA. MA with short proximal projection and slender prolateral projection. Embolus with stout, bifurcate tip. Palpal patella with one dorsal spine, palpal tibia with single prolateral spine. Female epigynum (Figs 14c–d) with small lateral teeth, sclerotized gonopore openings prominent, with distinctly angled inner margin. Tarsal organ capsulate, situated distally to trichobothria.

Description. *Male*. Measurements: BL 9.40, CL 5.40, CW 3.85, PLE 0.44, PME 0.31 (MV, K 10768). *Female*. Measurements: BL 12.50, CL 5.60, CW 4.10, PLE 0.41, PME 0.25 (MV, K 4039). For morphological description see species diagnosis and generic description.

Etymology. The specific name refers to the bifid tip of the male embolus.

Distribution. Known only from south central Victoria (Fig. 27c)

Storenosoma bondi n.sp.

Figs 7d,j, 15a–b, 27c

Type material. HOLOTYPE ♂, Bondi State Forest [southeastern New South Wales, Australia], G. Gowing *et al.*, 37°08'S 149°09'E, 4 Jul 1980 (AMS KS52413). PARATYPES: 1♂, same data as holotype (AMS KS86737). 1♀, same data except 1980 (AMS KS71789).

Other material examined. NEW SOUTH WALES: 3♂, Bondi State Forest, G. Gowing *et al.*, 3 Aug 1980 (KS18071). 1♂, same data except 14 Nov 1980 (KS69897). 1♂, same data except 25 Oct 1980 (KS69898). 1♂, same data as except 37°07'S 149°08'E, 27 Aug 1980 (KS69095). 1♂, same data as except 4 Jul 1980 (KS69720). 1♂, same data as except 37°07'S 149°08'E, 3 Aug 1980 (KS69095) (also KS81295–81305) (all AMS). 2♂, Kosciuszko NP, Mt Clarke, 36°26'21"S 148°17'47"E, Apr 2005, K. Green (ANIC).

Diagnosis. Male palp (Figs 15a–b) with short triangular TA. MA with moderately elongate proximal projection expanding to paddle shaped tip and with rather short and broad prolateral projection. Embolus with pointed tip. Palpal patella with one dorsal spine, palpal tibia with single slender prolateral spine. Female epigynum unknown. Tarsal organ capsulate (Fig. 7d–j), situated between trichobothria 1 and 2.

Description. *Male*. Measurements: BL 6.90, CL 3.65, CW 2.94, PLE 0.31, PME 0.22, (AMS KS52413). *Female*. Measurements: BL 6.50, CL 3.00, CW 2.12, PLE 0.30, PME 0.20, (AMS KS71789). For morphological description see species diagnosis and generic description.

Etymology. The specific name is noun in apposition taken from the type locality.

Distribution. Known only from the south east corner of New South Wales (Fig. 27c).

Remarks. The single female specimen attributed to this species above has the epigynum plugged making it's morphology unclear. For this reason it has not been illustrated. However, the relatively wide separation of the sclerotized gonopore openings compared to those of *S. hoggi*, the only sympatric species of similar size, suggests it is most likely *S. bondi*.

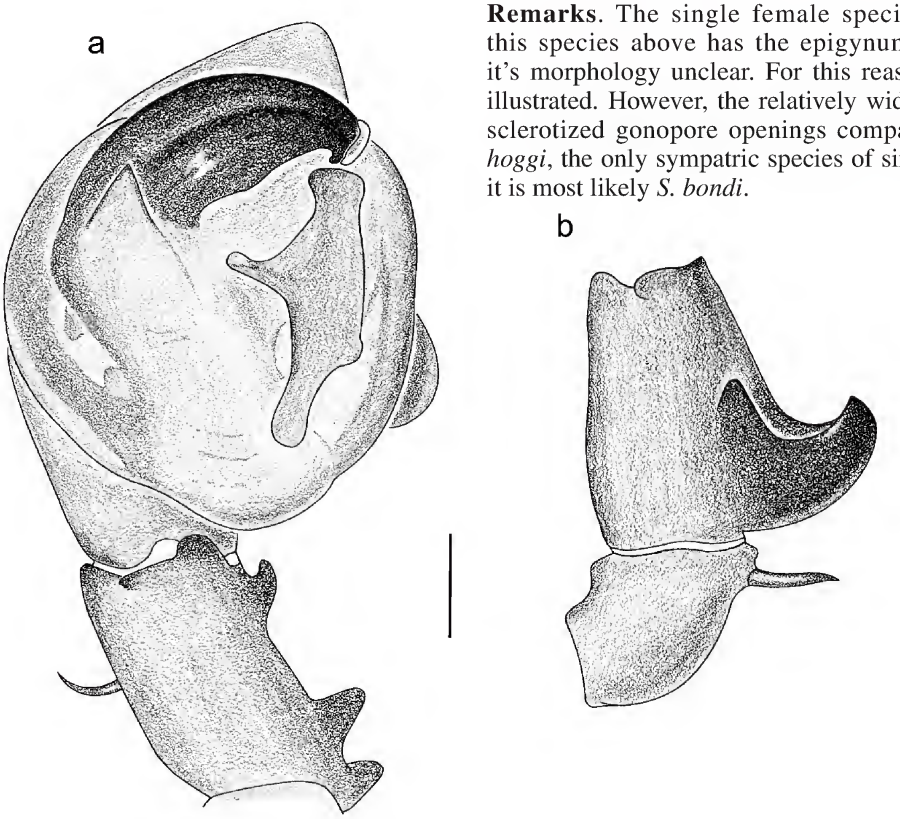

Fig. 15. *Storenosoma bondi. (a–b)* male palp (KS18071): *(a)* ventral; *(b)* RTA, retrolateral. Scale line 0.25 mm.

Storenosoma forsteri n.sp.

Figs 8a,e, 16a–d, 27a

Type material. HOLOTYPE ♂, Mt Wilson, Waterfall Picnic Area Trail, 33°30'S 150°23'E, 17 Jun 1979, CH (AMS KS3136). PARATYPES 3♂, same data (AMS KS86738). 2♀, Kanangra-Boyd National Park, Blood Filly Creek near Jenolan Caves, 33°53'S 150°04'E, 27 Mar 1976, MRG *et al.* (AMS KS29973).

Other material examined. AUSTRALIAN CAPITAL TERRITORY: 3♂, 2♀, Tidbinbilla Nature Reserve, 35°28'S 148°52'E, 9 Mar 1978, P. Ormay (KS14292). 1♀, same data (KS13845). 1♀, same data (KS13952). 1♀, same data (KS14271) (all AMS).

NEW SOUTH WALES: 3♂, Barren Grounds Nature Reserve, 14 km NW of Jamberoo, 33°40'28"S 150°42'45"E, 1–5 Jun 1999, L. Gibson (KS69799). 1♂, same data except 21–25 Jun 1999 (KS69800). 1♂, same data except 16–20 Aug 1999 (KS69801). 1♂, 1♀, same data except 21–25 Aug 1999 (KS69802). 5♂, Blue Mountains N.P., Binnowee Drive, 33°40'15"S 150°27'55"E, 15 Aug 1996, AMS KS53262. 3♂, same data (KS53263). 1♂, same data (KS53264). 2♂, same data (KS53265). 1♂, same data (KS53266). 1♀, same data (KS53267). 1♂, same data (KS53268). 1♂, same data (KS53269). 3♂, 1♀, same data (KS53270). 2♂, same data (KS53271). 2♂, same data (KS53272). 2♂, same data (KS53273). 1♂, same data (KS53274). 1♂, same data (KS53275). 3♂, same data (KS53276). 1♂, same data (KS53277). 1♂, same data (KS53278). 2♂, same data (KS53279). 1♂, same data (KS52408). 2♂, same data (KS52407). 1♀, Brindabella, Rules Point Rd., 35°24'S 145°45'E, 1 Apr 1988, M. Zabka & G. Hunt (KS44975). 1♂, Gordon, 33°44'S 151°09'E, 18 Jul 1982, CH (KS9751). 1♂, same data except 21 Jul 1983 (KS12643). 2♂, Hazelbrook, Coates Park, 33°43'45"S 150°20'45"E, 22 Aug 1996, AMS KS53280. 1♂, same data (KS53281). 1♂, same data (KS53282). 1♂, same data (KS53283). 1♂, same data (KS53284). 91♂, 3♀, Jenolan Caves, 'Playing Fields', 33°49'S 150°02'E, 6 Jul 1989, G. Hunt (KS21655). 104♂, 1♀, same data except 14 Aug 1989 (KS22524). 24♂, 1♀, Jenolan Caves area, Southern Limestone Area, 33°49'S 150°02'E, 6 Jul 1989, G. Hunt (KS21668). 17♂, 3♀, same data except 14 Aug 1989 (KS22532). 1♀, Kanangra Boyd National Park, 33°59'S 150°08'E, 8 Jun 1971, G. Hunt (KS52410). 1♂, Kanangra-Boyd National Park, Blood Filly Creek near Jenolan Caves, 33°53'S 150°04'E, 27 Mar 1976, MRG *et al.* (KS29846). 2♂, 1♀, same data (KS29989). 4♂, 1♀, Kanangra-Boyd Nat. Pk., Boyd Plateau, 33°56'S 150°08'E, 1972, MRG (KS30404). 1♀, Kanangra-Boyd National Park, Empress Firetrail turnoff, 33°59'S 150°08'E, 27 Mar 1976, MRG *et al.* (KS29488). 16♂, Mt Kembla, Sydney Catchment Authority Reserve, 34°26'33"S 150°44'24"E, 6–10 Aug 1999, L. Gibson (KS69796). 11♂, 1♀, same data except 16–20 Aug 1999 (KS69795). 3♂, same data except 21–25 Aug 1999 (KS69798). 1♂, same data except 6–10 Jun 1999 (KS69791). 3♂, same data except 11–15 Aug 1999 (KS69797). 5♂, same data except 1–5 Aug 1999 (KS69794). 1♂, 1♀, same data except 16–20 Jun 1999 (KS69792). 1♀, same data except 11–15 Dec 1998 (KS69789). 1♀, same data except 1–5 Jun 1999 (KS69790). 1♀, same data except 21–25 Jun 1999 (KS69793). 1♂, Mt Wilson, Cathedral of Ferns area, 33°30'S 150°23'E, 16 Jun 1978, CH (KS1547). 2♂, same data (KS69845). 6♂, 1♀, same data except 14 Jul 1978, MRG (KS1639). 3♂m, 2♀, same data except 14 Aug 1978, CH (KS1678). 3♂, same data except 7 Sep 1978 (KS69844). 3♂, same data except 5 Oct 1978 (KS1996). 2♂, same data except 1 Nov 1978, MRG & CH (KS2044). 1♂, same data except 17 Jun 1979, CH (KS3819). 1♀, same data, (KS69887). 2♀, same data except 28 Jan 1979 (KS2635). 2♂, same data except 17 Jul 1979 (KS3843). 1♂, same data except 12 Aug 1979 (KS3883). 1♀, same data except 4 Oct 1979 (KS5482). 5♂, Wahroonga Fox Valley Reserve, 33°42'S 151°08'E, 1 Sep 1979, B. Henke (KS5372). 1♀, same data except 5 Jan 1980 (KS6312). 1♀, same data except 13 Jan 1980 (KS6340). 33♂, 4♀, Wombeyan Caves, hillside north of campground, 34°19'S 149°59'E, 7 Jul 1989, G. Hunt (KS21688). 36♂, same data except 14 Aug 1989 (KS22507). 1♂, same data (KS22546). 2♂, same data except 17 Jun 1990 (KS29658). 1♀, Woodford, Ridge St., 33°43'50"S 150°28'40"E, 30 Sep 1996, AMS KS52409 (all AMS).

Diagnosis. Male palp (Figs 16a–b) with reduced TA. MA with elongate proximal projection curving prolaterally, expanding to paddle shaped tip and with rather short and broad prolateral projection. Embolus with blunt tip. Palpal patella with one or two dorsal spines, palpal tibia with single

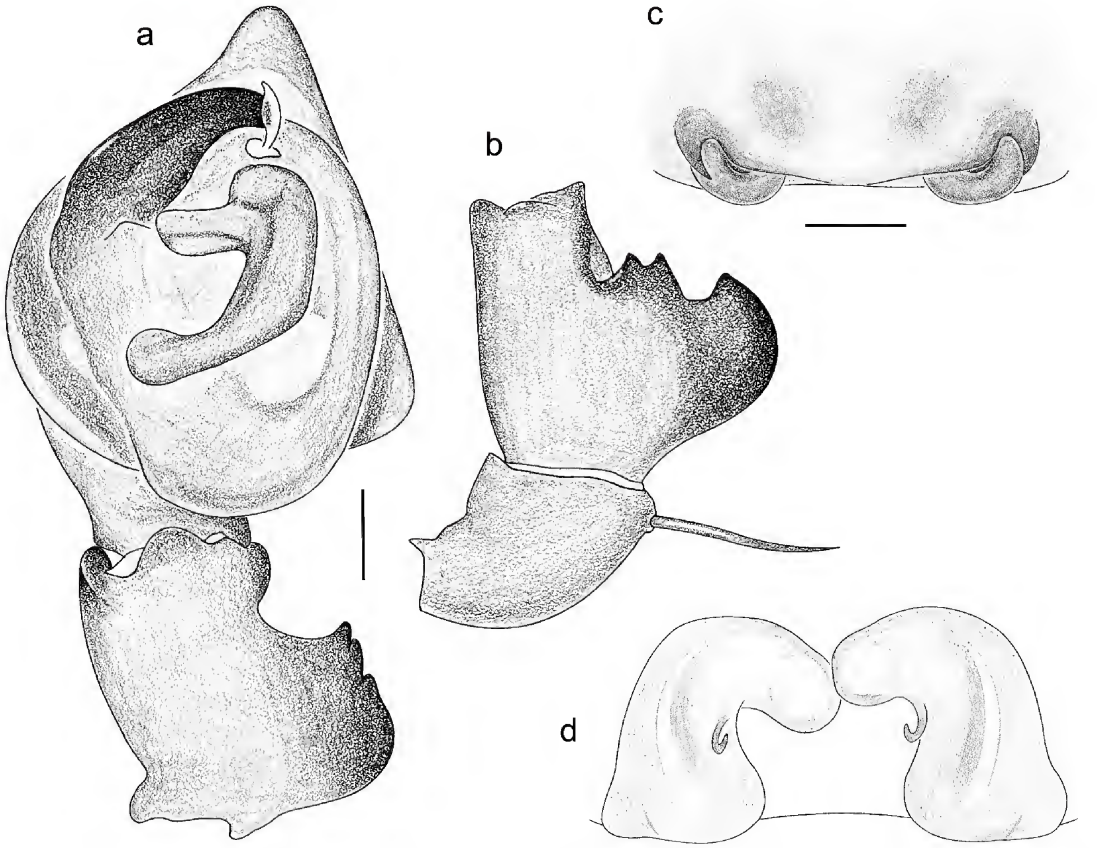

Fig. 16. *Storenosoma forsteri. (a–b)* male palp (KS3136): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (KS29973): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

slender dorsal spine. Female epigynum (Figs 16c–d) with pronounced, hook-like lateral teeth. Tarsal organ capsulate (Figs 8a,e), situated distally to trichobothria.

Description. *Male*. Measurements: BL 7.50, CL 4.00, CW 3.15, PLE 0.37, PME 0.25 (AMS KS3136). *Female*. Measurements: BL 8.20, CL 3.30, CW 2.34, PLE 0.33, PME 0.20 (AMS KS29973). For morphological description see species diagnosis and generic description.

Etymology. The specific name is in honour of the late Dr R. Forster who first illustrated the male palp of this species (Forster & Wilton, 1973: fig. 820).

Distribution. Known only from central eastern New South Wales (Fig. 27a)

Storenosoma grayi n.sp.

Figs 7a,e–f, 17a–d, 27b

Type material. HOLOTYPE ♂, "Scalloway", Willowvale, near Gerrigong, NSW, 34°45'S 150°50'E, 24 Jun 1989, G. Wishart (AMS KS31749). PARATYPES: 1♂, 1♀, Macquarie Rd, Buckenbowra State Forest, NSW, 35°38'09"S 149°53'16"E, 16 Mar 1999, L. Wilkie, R. Harris & H. Smith (AMS KS68199).

Other material examined. NEW SOUTH WALES: 1♀, Badja Fire Trail, Badja State Forest, 36°07'30"S 149°31'37"E, 13 Mar 1999, J. Tarnawski & S. Lassau (KS69903). 1♀, same data (KS69904). 3♀, Boundary Fire Trail, Monga State Forest, 35°37'22"S 149°54'43"E, 15 Mar 1999, L. Wilkie, R. Harris & H. Smith (KS69902). 1♀, Burkes Rd, Badja State Forest, 36°10'33"S 149°31'58"E, 13 Mar 1999, J. Tarnawski & S. Lassau (KS68201). 1♀, Coondella Fire Trail, Deua National Park, 35°58'44"S 149°53'05"E, 11 Mar 1999, J. Tarnawski & S. Lassau (KS69909). 1♀, same data except 35°58'47"S 149°53'13"E, (KS69910). 1♀, Dampier Mt Fire Trail, Deua National Park, 35°59'09"S 149°42'32"E, 11 Mar 1999, J. Tarnawski & S. Lassau (KS69907). 2♀, same data except 35°58'26"S 149°41'20"E, (KS69908). 1♀, Macquarie Rd, Buckenbowra State Forest, 35°38'09"S 149°53'16"E, 16 Mar 1999, L. Wilkie, R. Harris & H. Smith (KS69911). 1♀, Peters Rd, Badja State Forest, 36°08'52"S 149°32'09"E, 13 Mar 1999, J. Tarnawski & S. Lassau (KS69906). 2♂, 5♀, Rocky Pic Rd, Tallaganda State Forest, 35°37'08"S 149°30'17"E, 15 Mar 1999, J. Tarnawski & S. Lassau (KS69899). 1♀, same data except 35°35'34"S 149°30'14"E, (KS69900). 1♂, 1♀, South Forest Way, Tallaganda State Forest, 35°42'50"S 149°32'20"E, 15 Mar 1999, J. Tarnawski & S. Lassau (KS69901). 1♀, Wiola Creek Fire Trail, Badja State Forest, 36°05'24"S 149°34'51"E, 13 Mar 1999, J. Tarnawski & S. Lassau (KS69905) (all AMS). 3♀, Clyde Mt., 3 Mar 1968, J. Balderson. 1♂, 3♀, Clyde Mt., 3 Mar 1970, S. Curtis. 7♂, 4♀, Clyde Mt., 14 Apr 1970, E.F. Riek. 2♂, 1♀, Clyde Mt., 15 Jul 1973, R.J. Kohout. 3♂, 2♀, Clyde Mt., 35°33'S 149°57'E, 15 May 1984, R.B. Halliday & M.S. Harvey. 2♂, 2♀, Clyde Mt., 4 Sep 1982, L.Hill. 2♂, 2♀, 2 km N of Monga, 18 Sep 1983, M.S. Harvey (all ANIC).

Diagnosis. Male palp (Figs 17a–b) with low blunt tipped TA. MA with elongate proximal projection, curving prolaterally with blunt rounded tip and with short narrow prolateral projection. Embolus with bluntly pointed tip and sometimes with expanded section near base. Palpal patella with one dorsal spine, palpal tibia with one dorsal and one prolateral stout spine. Female epigynum (Figs 17c–d) with pronounced lateral teeth. Tarsal organ rod like, situated proximally to trichobothria.

Description. *Male*. Measurements: BL 6.25, CL 3.40, CW 2.50, PLE 0.35, PME 0.20 (AMS KS31749). *Female*. Measurements: BL 6.25, CL 3.20, CW 2.40, PLE 0.35, PME 0.20 (AMS KS68199). For morphological description see species diagnosis and generic description.

Etymology. The specific name is in honour of Dr M.R. Gray for his contributions to Australian arachnology.

Distribution. Known from south eastern New South Wales (Fig. 27b).

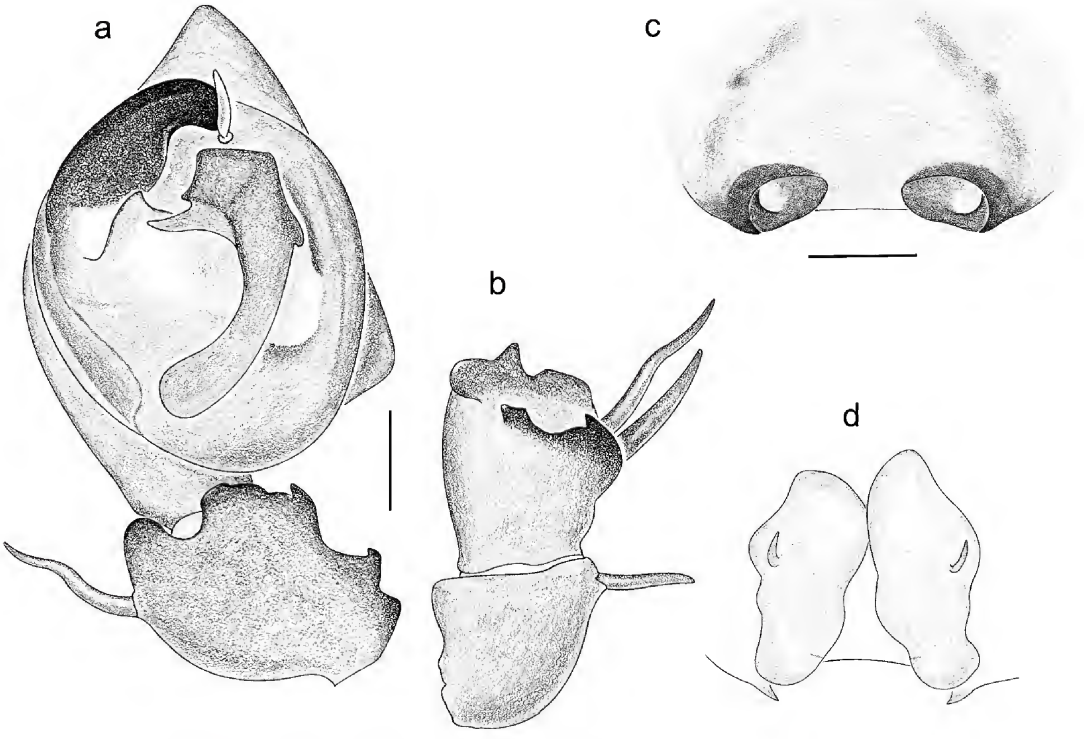

Fig. 17. *Storenosoma grayi*. *(a–b)* male palp (KS31749): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (KS69899): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

Remarks. This species is known from the type locality, near Gerringong, south to the forests west of Moruya. Males from the southern end of the range have a less prominent TA and the proximal projection of the MA is narrower and more curved.

Storenosoma grossum n.sp.

Figs 18a–d, 27c

Type material. HOLOTYPE ♂, Beech Forest, 38°38'S 143°34'E, 7 Apr 1973, MRG (AMS KS55348). PARATYPES 1♂, Delley's Dell, Grampians Ranges, 37°08'S 142°26'E, 26 Mar 1974, MRG (AMS KS4578). 3♀, Otway Ranges, Young Creek Rd, 0.4 km NW of Triplet Falls, 38°40'S 143°29'E, 14 Jun–29 Aug 1995, GAM, (NMV K4015). 2♀, Otway Ranges, Maits Rest, 10 km W of Apollo Bay, 38°45'S 143°34'E, 22 Feb 1992, GAM, (NMV K40009).

Other material examined. VICTORIA: 1♂, Macedon, Hogg Collection (1924.3.1.1425) (BMNH). 1♀, Delly's Dell, Silverband Rd, Grampians Range, 22 Mar 1974, MRG, (KS105859). 1♀, 14 km S of Halls Gap, Lower Silverband Rd, 37°08'S 142°31'E, 24 Mar 1974, MRG (KS105853) (both AMS). 2♂, Otway Ranges, Phillips Track, 0.5 km N of Triplet Falls, 38°40'S 143°29'E, 30 Oct 1991, GAM, (K 4011). 2♂, same data except 30 Oct–6 Nov 1991 (K 4012). 1♀, same data (K 3995). 1♂, same data except 6–13 Nov 1991 (K 4013). 1♂, same data except, 6 Sep–15 Nov 1994, (K 4014). 1♀, same data (K 3996). 1♀, same data except 31 Jan–11 Apr 1995 (K 3997). 1♀, same data except 14 Jun–29 Aug 1995 (K 3998). 1♀, same data (K 4005). 1♂, Otway Ranges, Young Creek Rd, 0.4 km NW of Triplet Falls, 38°40'S 143°29'E, 14 Jun–29 Aug 1995, GAM, (K 4015). 1♀, same data except 31 Jan 1994 (K 4000). 1♀, 6 Sep–15 Nov 1994 (K 3999). 3♂, Otway Ranges, Young Creek Rd, 0.2 km NE of Ciancio Creek crossing, 38°42'S 143°29'E, 6 Sep–15 Nov 1994, GAM, (K 4020). 1♀, same data (K 4003). 2♂, same data (K 4016). 1♀, same data (K 4002). 2♂, same data except 15 Nov–31 Jan 1995, (K 4018). 1♀, same data (K 4004). 1♂, same data (K 4017). 1♂, same data except 14 Jun–29 Aug 1995 (K 4019). 1♀, same data (K 4006). 1♂, Otway Ranges, Aire Crossing Track, 0.5 km N of Aire River crossing, 38°42'S 143°29'E, 15 Nov 1994–31 Jan 1995, GAM, (K 4021). 2♂, same data (K 4022). 1♀, same data except 11 Apr–14 Jun 1995 (K 4008). 1♂, same data except 14 Jun–29 Aug 1995 (K 4007). 1♂, Otway Ranges, Maits Rest, 10 km W of Apollo Bay, 38°45'S 143°34'E, 4–10 Dec 1991, GAM, (K 4023). 1♂, same data except 6–13 Nov 1991 (K 4024). 2♀, same data except 22 Oct 1991 (K 4010). (all NMV). 1♀, Mt Sabine, Otway Ranges, 38°38'S 143°43'E, 585 m, 6 Nov 1997, GBM (S 46471) (QM).

Diagnosis. Male palp (Figs 18a–b) with small blunt tipped TA. MA with short proximal pointed projection, directed prolaterally and with similar but broader distal projection. Embolus simple and relatively narrow, with pointed tip. Palpal patella with one dorsal spine, palpal tibia with one slender dorsal spine. Female epigynum (Figs 18c–d) with lateral teeth located ventral to sclerotized gonopore openings. Tarsal organ capsulate, situated distally of trichobothria.

Description. *Male*. Measurements: BL 9.90, CL 5.10, CW 3.75, PLE 0.38, PME 0.26 (AMS KS55348). *Female*. Measurements: BL 10.60, CL 5.10, CW 3.85, PLE 0.40, PME 0.26, (NMV K4009). For morphological description see species diagnosis and generic description.

Etymology. Specific epithet refers to the relatively large size of this species.

Distribution. Known only from south western Victoria (Fig. 27c).

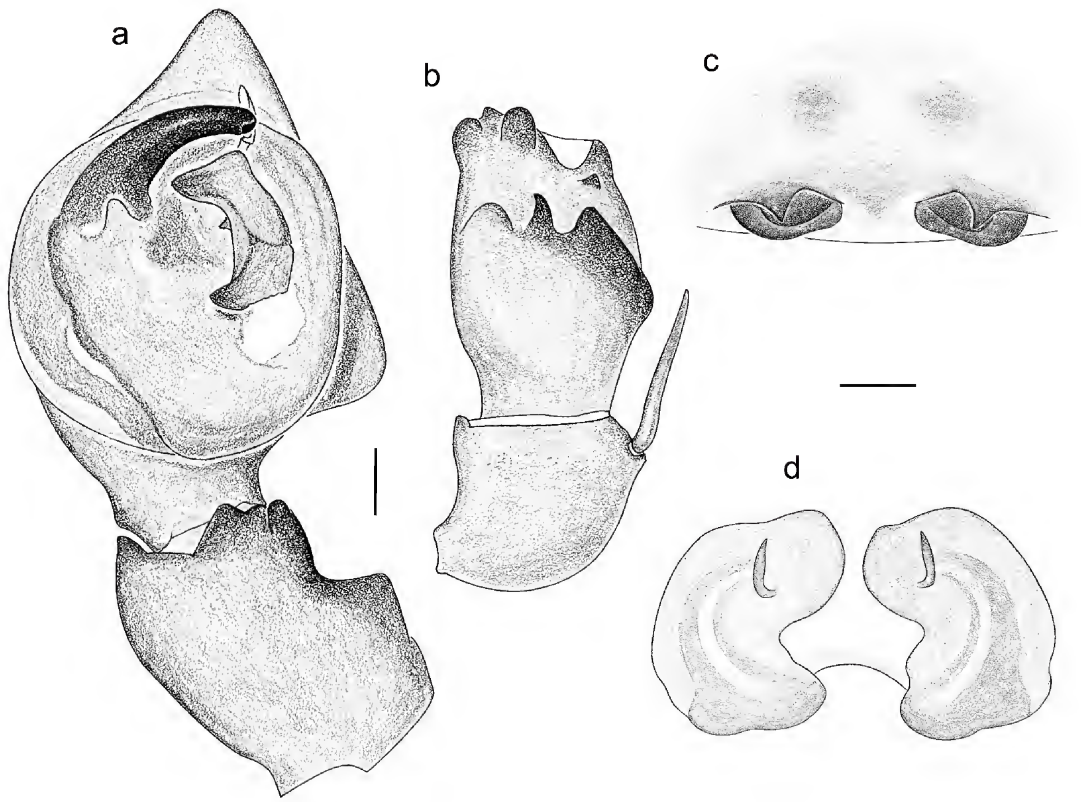

Fig. 18. *Storenosoma grossum. (a–b)* male palp (K4022): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (K4001); *(d)* internal (K4010). Scale lines 0.25 mm.

Storenosoma hoggi (Roewer)

Figs 1c, 2a–d, 3a–e, 5a–f, 7c,i, 19a–d, 27a

Storenosoma lycosoides Hogg, 1900: 95, pl. 14, fig. 3.
Storena hoggi Roewer, 1942: 362 (replacement name for *S. lycosoides*, believed preoccupied in *Storena* by Nicolet, 1849).
Storenosoma lycosoides.–Davies, 1986: 240, figs 13–15 (transferred from *Storena*, using name of unavailable secondary homonym replaced before 1961).
Storenosoma hoggi.–this combination listed online (*World Spider Catalog* version 11.5, Platnick, 2011).

Type material examined. LECTOTYPE ♀, Macedon, Victoria, 1907.2.24.34–37 (part), (BMNH). PARALECTOTYPES 1♂, 2♀, Macedon, Victoria, 1907.2.24.34 (part) (BMNH).

Other material examined. NEW SOUTH WALES 1♀, Badja SF Fire Rd, Badja State Forest, 36°10'51"S 149°29'45"E, 13 Mar 1999, L. Wilkie *et al.* (KS69836). 1♂, 5 km E of Bega, Mimosa Rocks NP, Dr George Mt Rd, 36°39'42"S 149°54'25"E, 25 Oct 2006, C. Car (KS105460). 1♂, 15 km N of Bega, Biamanga NP, Murbulla Creek Rd, 36°34'15"S 149°51'35"E, 25 Oct 2006, C. Car (KS105569). 1♂, same data except 15 Jun 2006, (KS105769). 1♂, Bondi State Forest, S of Bombala, Woodlot 1, 37°08'S 149°09'E, 25 Oct 1980, G. Gowing (KS11150). 1♀, same data (KS10996). 1♂, same data (KS11012). 1♂, same data (KS11030). 2♂, same data (KS11054). 1♂, 1♀, same data (KS11072). 3♂, same data (KS11085). 3♂, same data (KS11089). 5♂, 1♀, same data (KS11097). 1♂, same data (KS11108). 3♂, same data (KS11101). 1♂, same data (KS11122). 7♂, same data (KS11118). 1♂, same data except 15 Oct 1980 (KS11202). 1♀, same data (KS11301). 3♂, same data (KS11286). 1♀, same data (KS11226). 5♂, 1♀, same data (KS11236). 2♂, 2♀, same data (KS11247). 1♂, 1♀, same data (KS11254). 4♂, 3♀, same data (KS11267). 1♂, same data (KS11296). 7♂, same data (KS11313). 2♂, 2♀, same data (KS11329). 1♂, same data except 14 Nov 1980 (KS11542). 3♂, same data (KS11554). 1♀, same data (KS11637). 1♀, same data (KS11657). 1♂, same data (KS11723). 2♂, 1♀, same data (KS11937). 2♂, same data (KS11946). 5♂, 1♀, same data (KS11955). 2♂, same data (KS11965). 2♂, 1♀, same data (KS11972). 2♂, 3♀, same data (KS11987). 1♂, 1♀, same data except 6 May 1980 (KS12210). 1♀, same data except 1 Jul 1981 (KS11454). 1♀, same data (KS11503). 3♂, same data except 4 Jul 1980 (KS45439). 1♂, same data (KS69830). 1♂, same data (KS69825). 1♀, same data except 27 Sep 1980 (KS69828). 1♂, same data (KS55350). 1♂, same data except 3 Aug 1980 (KS69829). 2♂, same data (KS69832). 1♂, same data (KS69824). 1♂, same data (KS69826). 1♀, same data except 26 Aug 1980 (KS69831). 1♂, same data (KS69833). 1♂, same data (KS69834). 1♂, same data except woodlot 2, 37°07'S 149°09'E, 4 Jul 1980 (KS69835). 1♂, same data (KS69723). 1♂, same data (KS69827). 1♂, same data (KS69721). 3♂, same data (KS69722). 4♂, same data (KS69712). 3♂2♀, same data except 27 Aug 1980 (KS69070). 1♂, same data (KS69118). 1♀, same data (KS69082). 2♂, same data (KS69074). 1♂1♀, same data (KS69102). 3♂1♀, same data (KS69111). 3♂1♀, same data (KS69077). 2♂3♀, same data (KS69089). 1♀, same data except 28 Nov 1980 (KS69174). 1 m, same data except 5 May 1980 (KS69195). 1♀, same data except 3 Feb 1980 (KS69709). 1♀, Dampier Mt. Fire Trail, Deua National Park, 35°58'44"S 149°41'23"E, 11 Mar 1999, J. Tarnawski & S. Lassau (KS69837). 1♀, 1.5 km S of Kiah, 37°09'S 149°51'E, 14 Apr 1978, MRG (KS45577). 2♂, 32 km E of Cooma, Wadbilliga NP, Tuross Falls, 2.8 km from Peter Rd turnoff, 36°11'58"S 149°30'12"E, 24 Oct 2006, C. Car (KS105493). 2♂, 15 km SE of Countegany, Two River Plain, Wadbilliga Trail NP, 36°17'50"S 149°32'32"E, 24 Oct 2006, C. Car (KS105590). 1♂, Kosciuszko NP, near Yarrangobilly Caves, 35°40'26"S 148°20'08"E, 16 Jun 2006, C. Car (KS105550). 2♂, 1♀, same data except 23 Oct 2006 (KS105581). 1♂, 10 km SE of Nimmitabel, Glen Bog SF, 36°36'46"S 149°22'07"E, 24 Oct 2006, C. Car (KS105517). 1♂, 9 km SE of Talbingo, Kosciuszko NP, Black Perry Rest Place, 35°36'01"S 148°22'18"E, 23 Oct 2006, C. Car (KS105529). 1♂, same data except 13 Jun 2006 (KS105666). 1♂, Two River Plain, Wadbilliga NP, Wadbilliga Trail, 36°17'50"S 149°32'32"E, C. Car (KS105537). 1♂, Yarrangobilly Caves, 35°40'S 148°30'E, G. Hunt & M. Zabka (KS44792) (all AMS). 1♀, Brown Mt, near Nimmitabel, Rutherford Ck., 26 May 1970, W.T. & R. Bartell. 1♀, 8.8 km ESE of Captains Flat, 10 Jan 1970, R.W. Taylor. 23♂3♀, 4 km E of Mt Wog Wog, 17 km SE of Bombala, 37°04'30"S 149°28'00"E, Jul 1986, C.R. Margules. 1♂2♀, same data except Oct 1986 (all ANIC). 2♀, NE of Khancoban, 36°12'S 148°08'E, 22 May 1988, D. Hirst (N19733–2) (SAM).

VICTORIA: 1♂, Blackwarri Scenic Rd., 0.5 km S of Blackwarri, 38°24'S 146°37'E, 11 Apr 1978, MRG (KS52412). 1♀, Waygara State Forest, 20 km N of Orbost, 37°42'S 148°19'E, 14 Apr 1978, MRG (KS45228). 1♂, 6.4 km E of Woodend on Mt Macedon Rd, 37°28'S 144°37'E, 28 Mar 1974, MRG (KS105861). 1♂, Mt Worth State Park, near Seaview, 38°16'S 145°59'E, 23

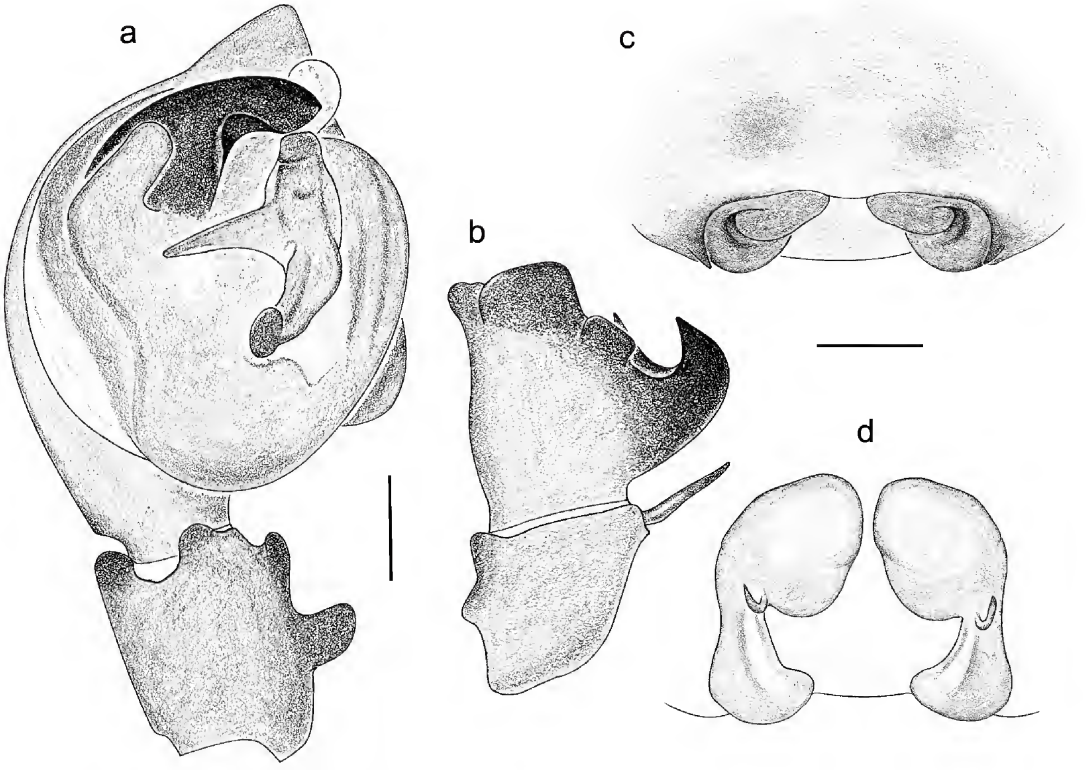

Fig. 19. *Storenosoma hoggi. (a–b)* male palp (K4041): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (K4110): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

Mar 1978, MRG (KS52411) (all AMS). 1♂, Powers Lookout, 28 km NE of Mansfield, 17 May 1967, R. McInnes. 3♂, Wilsons Promontory National Park, 12–16 May 1978, S. & J. Peck (all ANIC). 1♂, Barringo, 5 km E of Macedon, 15 Apr 1972 (K 4100). 1♂, 1♀, [East Gippsland], Cobon South forest coupe 507.07, 37°25'S 148°56'E, upslope site, 6–11 May 1992, RC (K 4055). 2♂, same data except midslope site (K 4094). 4♀, same data (K 4059). 1♀, same data except upslope site, 6–14 Apr 1992 (K 4054). 1♀, same data (K 4056). 2♀, same data except gully site, 19–26 Feb 1992 (K 4057). 1♂, [East Gippsland], Cobon South forest coupe 513.04, 37°25'S 148°58'E, midslope site, 5–11 May 1992, RC (K 4061). 1♀, same data except gully site (K 4063). 1♀, same data except 5–12 Mar 1992 (K 4058). 1♂, [East Gippsland], Cobon South forest coupe 513.06, 37°25'S 148°58'E, midslope site, 29 Apr to 5 May 1992, RC (K 4062). 1♂, same data except 10–16 Dec 1991 (K 4064). 1♂, same data except upslope site, 5–11 May 1992 (K 4060). 1♂, [East Gippsland], Cobon North forest coupe 512.08, 37°22'S 148°56'E, upslope site, 5–11 May 1992, RC (K 4050). 1♂, 1♀, same data except 15–21 Jan 1992 (K 4051). 1♂, 1♀, same data except 12–20 Dec 1991 (K 4053). 1♀, same data except gully site (K 4049). 1♂, same data except 5–11 May 1992 (K 4052). 1♀, same data (K 4045). 1♀, same data except, midslope site (K 4046). 1♀, same data except 6–10 Apr 1992 (K 4048). 1♀, same data except upslope site (K 4110). 1♂, [East Gippsland], Cobon North forest coupe 513.03, 37°23'S 148°56'E, midslope site, 16–22 Jan 1992, RC (K 4044). 1♀, same data except gully site (K 4047). 1♀, [East Gippsland], Sardine forest coupe 513.02, 37°24'S 148°31'E, midslope site, 2–9 Apr 1992, RC (K 4071). 2♀, same data except 23–30 Jan 1992 (K 4073). 6♀, same data except upslope site (K 4075). 1♂, [East Gippsland], Sardine forest coupe 513.04, 37°25'S 148°31'E, midslope site, 4–10 May 1992, RC (K 4080). 1♀, same data (K 4069). 2♂, same data except upslope site (K 4091). 1♀, same data (K 4065). 1♀, same data (K 4070). 1♀, same data except midslope site, 9–15 Apr 1992 (K 4068). 1♀, same data except upslope site, 2–9 Apr 1992 (K 4072). 6♂, [East Gippsland], Sardine forest coupe 513.06, 37°24'S 148°31'E, gully site, 10–15 May 1992, RC (K 4079). 1♀, same data (K 4074). 2♀, same data except midslope site (K 4066). 2♂, same data except 31 May to 7 Jun 1992 (K 4078). 1♂, 1♀, same data except upslope site (K 4077). 6♀, same data except midslope site, 24–30 Jan 1992 (K 4067). 6♀, same data except upslope site (K4076). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 509.08, 37°34'S 148°39'E, midslope site, 7–13 May 1992, RC (K 4085). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 509.06, 37°34'S 148°49'E, midslope site, 28 Oct to 5 Nov 1991, RC (K 4089). 1♀, same data except upslope site, 7–13 May 1992 (K 4084). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 510.07, 37°34'S 148°38'E, midslope site, 24–29 Oct 1991, RC (K 4090). 2♂, same data except upslope site, 27 Oct to 4 Nov 1991 (K 4093). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 510.08, 37°34'S 148°38'E, gully site, 26 Oct to 3 Nov 1991, RC (K 4092). 1♂, same data except midslope site (K 4078). 1♂, same data except 7–13 May 1992 (K 4088). 1♂, 1♀, same data except gully site (K 4095). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 515.05, 37°34'S 148°38'E, midslope site, 25 Oct to 4 Nov 1991, RC (K 4086). 1♀, same data except upslope site, 7–13 May 1992 (K 4081). 1♀, same data except midslope site (K 4083). 1♀, [East Gippsland], Rich-Murrungowar forest coupe 515.07, 37°34'S 148°38'E, gully site, 29 Oct to 6 Nov 1991, RC (K 4082). 1♀, Mount Hotham, Jan 1947, RJM (K 4099). 11♂, DCE Upper Yarra site 1, 9.2 km NW of Toorongo, 37°44'S 146°02'E, 14–24 Nov 1988, L. Lumsden (K 4040). 6♂, DCE Upper Yarra site 6, 11 km NE of McMahons Creek, 37°39'S 145°56'E, 14–24 Nov 1988, L. Lumsden (K 4041). 5♂, DCE Upper Yarra site 8, 11.4 km ENE of McMahons Creek, 37°41'S 145°57'E, 14–24 Nov 1988, L. Lumsden (K 4042). 1♂, DCE Upper Yarra site 9, 9.6 km E of McMahons Creek, 37°41'S 145°56'E, 14–24 Nov 1988, L. Lumsden (K 4043). 1♂, Strzelecki Ranges, Jeeralang West Rd, 0.1 km N of Binns Hill Junction, 38°26'30"S 146°29'E, 7 May to 16 Jul 1996, GAM (K 4096). 2♀, same data except 5 Mar–7 May 1996 (K 4097). 1♀, Suggan Buggan, upper Snowy area (K 4098). (all NMV). 1♂, Erskine Falls, [near] Lorne, [38°30'S 143°55'E], 17 Jun 1987, RR (S 13100). 1♀, same data (S 13103). 1♀, 20 km N of Cann River, [37°24'S 149°09'E], 17 Jun 1987, RR (S 13098) (all QM). 1♂, Churchill, 38°19'S 146°26'E, 23 May 1993, R.de Souza-Daw (N197334). 5♂, 4♀, Holey Plains, 38°15'S 146°53'E, 9 Jun 1996, R. de Souza-Daw (N1997847–55). 2♀, Morwell National Park, 38°22'S 146°24'E, 20 Jan 1995, R.de Souza-Daw (N197337–8). 1♂, same data except 20 Nov 1994 (N197335) (all SAM). 1♀, S of Mallacoota Aerodrome, 21 Oct 1990, D. Black (95/1185) (WAM).

Diagnosis. Male palp (Figs 2a–d, 19a–b) with pronounced blunt tipped TA. MA with short proximal projection curving ventrally with blunt rounded tip and with elongate narrow prolateral projection. Embolus with bluntly pointed tip, medial constriction and expanded section near base (Figs 2a,b). Palpal patella with one dorsal spine, palpal tibia with one slender dorsal spine. Female epigynum (Figs 19c–d) with lateral teeth. Tarsal organ capsulate (Fig. 7i), situated between trichobothria 1 and 2.

Description. *Male*. Measurements: BL 6.62, CL 3.32, CW 2.36, PLE 0.30, PME 0.20 (NMV K4100). Leg spination (only surfaces bearing spines listed, left legs of NMV K4100): femur: I D 0-2-2, P 0-0-2; II D 1-3-1, P 0-0-1; III D 1-3-3; IV D 1-2-3; tibia: I P3-3-2, R 3-3-2; II D 1-0-0, P 3-2-3, R 3-3-2; III D 0-1-1, P 2-2-2, R 1-1-2; IV D 0-1-1, P 2-2-1, R 1-1-2; metatarsus; I P 3-3-2, R 1-2-1; II P 3-3-2, V 0-0-1, R 2-2-2; III D 1-2-0, P 2-2-2, V 2-0-0, R 1-2-2; IV D 1-1-0, P 1-1-2, V 2-2-1, R 1-1-1.

Female. Measurements: BL 8.80, CL 4.00, CW 3.00, PLE 0.37, PME 0.25 (NMV K4095).

Spinnerets (Figs 5a–f). Spigots (female, ANIC, NSW, 8.8 km ESE of Captains Flat): ALS: 2 MAP spigots; c.12 piriform spigots: PMS: 1 mAP spigot; 3 CY spigots; 3 aciniform spigots: PLS: 2 CY spigots; 5 aciniform spigots. For morphological description see species diagnosis and generic description.

Distribution. Known from eastern Victoria and south eastern New South Wales (Fig. 27a)

Remarks. The measurements given here are not of the type specimens, those are given by Davies (1986).

Storenosoma picadilly n.sp.

Figs 20a–b, 27c

Type material. HOLOTYPE ♂, ACT, Wombat Ck., 6 km NE of Picadilly Circus, 35°19'S 148°51'E, Jun 1985, Weir, Lawrence and Johnson (ANIC 42-001693). PARATYPES 5♂, same data. 1♂, 1♀, same data except Aug 1985. 1♂, same data except Jul 1985 (all ANIC).

Other material examined. AUSTRALIAN CAPITAL TERRITORY: 1♂, Blundells Ck., 3 km E of Picadilly Circus, 35°22'S 148°50'E, Jul 1985, Weir, Lawrence and Johnson. 1♂, same data except Sep 1985. 2♂, same data except Jun 1985. 2♂, Picadilly Circus, 35°22'S 148°48'E, Aug 1984, Lawrence, Weir and Johnson. 15♂, 1♀, Picadilly Circus, 35°22'S 148°48'E, Jun 1984, Lawrence, Weir and Johnson. 5♂, same data. 4♂, Wombat Ck., 6 km E of Picadilly Circus, 35°19'S 148°51'E, Jun 1984, Weir, Lawrence and Johnson (all ANIC).

NEW SOUTH WALES: 1♂, Newnes SF, Sunnyside Rd, 33°22'33"S 150°11'14"E, 15–30 Nov 2005, GAM *et al*. AMS KS93056.

Diagnosis. Male palp (Figs 20a–b) with TA consisting of two short, blunt tipped projections. MA with elongate proximal projection curving prolaterally and expanding to paddle shaped tip and with narrow, elongate prolateral projection. Embolus simple, broad at base with small basal expansion and narrow tip. Palpal patella with one dorsal spine, palpal tibia without spines. Female epigynum unknown. Tarsal organ capsulate, situated distally of trichobothria.

Description. *Male*. Measurements: BL 8.40, CL 4.20, CW 3.20, PLE 0.30, PME 0.20. *Female*. Measurements: BL 9.95, CL 4.20, CW 2.85, PLE 0.32, PME 0.24. For morphological description see species diagnosis and generic description.

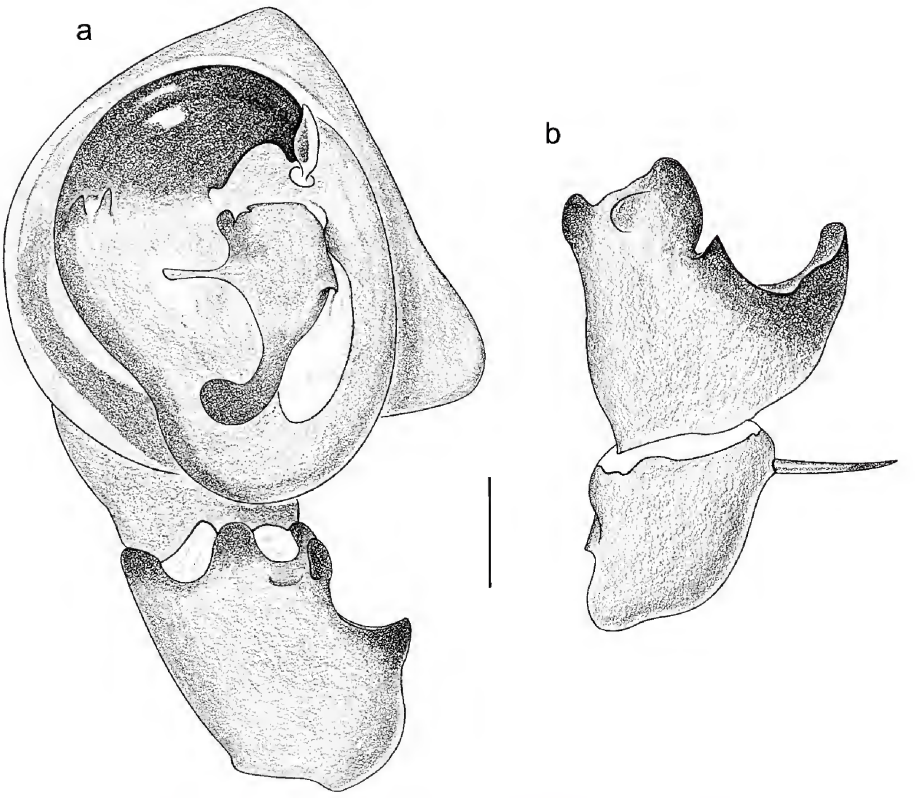

Fig. 20. *Storenosoma picadilly. (a–b)* male palp (ANIC, ACT, Wombat Ck., 6 km NE of Picadilly Circus): *(a)* ventral; *(b)* RTA, retrolateral. Scale line 0.25 mm.

Etymology. The specific name is a noun in apposition taken from the type locality.

Distribution. Known only from the vicinity of the type locality in the ACT and Newnes SF in NSW (Fig. 27c).

Remarks. The two female specimens attributed to this species have their epigyna plugged making the morphology unclear. For this reason the epigynum has not been illustrated. However, following the law of parsimony they have been attributed to *S. picadilly*, the only known sympatric species of similar size.

Storenosoma smithae n.sp.

Figs 8b,f, 21a–d, 27b

Type material. HOLOTYPE ♂, Kosciuszko NP, Mt Clarke, 36°26'08"S 148°17'27"E, Feb 2005, K. Green (ANIC 42-001694) [New South Wales, Australia]. PARATYPE 1♂, same data (ANIC).

Other material examined. NEW SOUTH WALES: 1♂, 1♀, Kosciuszko NP, Mt Clarke, 36°26'21"S 148°17'47"E, Mar 2005, K. Green. 1♂, Kosciuszko NP, Mt Clarke, 36°26'01"S 148°17'17"E, Feb 2005, K. Green. 2♀, same data except Mar 2004 (all ANIC).

Diagnosis. Male palp (Figs 21a–b) with small, narrow blunt tipped TA. MA without distinct proximal projection and with slender prolateral projection. Embolus relatively narrow, with pointed tip. Palpal patella with single stout dorsal hair, palpal tibia without spines. Female epigynum (Figs 21c–d) with small lateral teeth. Tarsal organ capsulate (Fig. 8b,f), situated distally of trichobothria.

Description. *Male*. Measurements: BL 6.25, CL 3.44, CW 2.56, PLE 0.33, PME 0.23.

Female. Measurements: BL 7.25, CL 3.60, CW 2.44, PLE 0.30, PME 0.21, (ANIC, NSW, Mt Clarke, Mar 2005). For morphological description see species diagnosis and generic description.

Etymology. The specific name is for Dr Helen Smith who drew my attention to these specimens.

Distribution. Known only from the Mt Clarke area in south eastern NSW (Fig. 27b).

Storenosoma supernum Davies

Figs 22a–d, 27a

Storenosoma superna Davies, 1986: 242, figs 20–23, 36.

Type material. HOLOTYPE ♀, Mt Hobwee, Lamington National Park, south east Queensland, [28°15'S 153°12'E], 1140 m, mossy microphyll forest with Nothofagus, pitfall trap, 7 Apr 1976, R. Raven & V. Davies (QM S1378). PARATYPES: 1♂, same data as holotype (QM S1379). 1♀, 9juv, same data except litter (QM S1381).

Other material. QUEENSLAND: 5♂, 7♀, Mt Hobwee, Lamington National Park, south east Queensland, 28 Mar 1976, RR & V. Davies (QM S30794). 4♀, Mt Baldy, 1969–70, C. Plowman (QM S30783).

NEW SOUTH WALES: 1♂, Bar Mountain, via Kyogle, [28°28'S 153°08'E], 7 Feb–27 Apr 1978, GBM & SRM (QM S30758).

Diagnosis. Male palp (Figs 22a–b) without TA. MA with

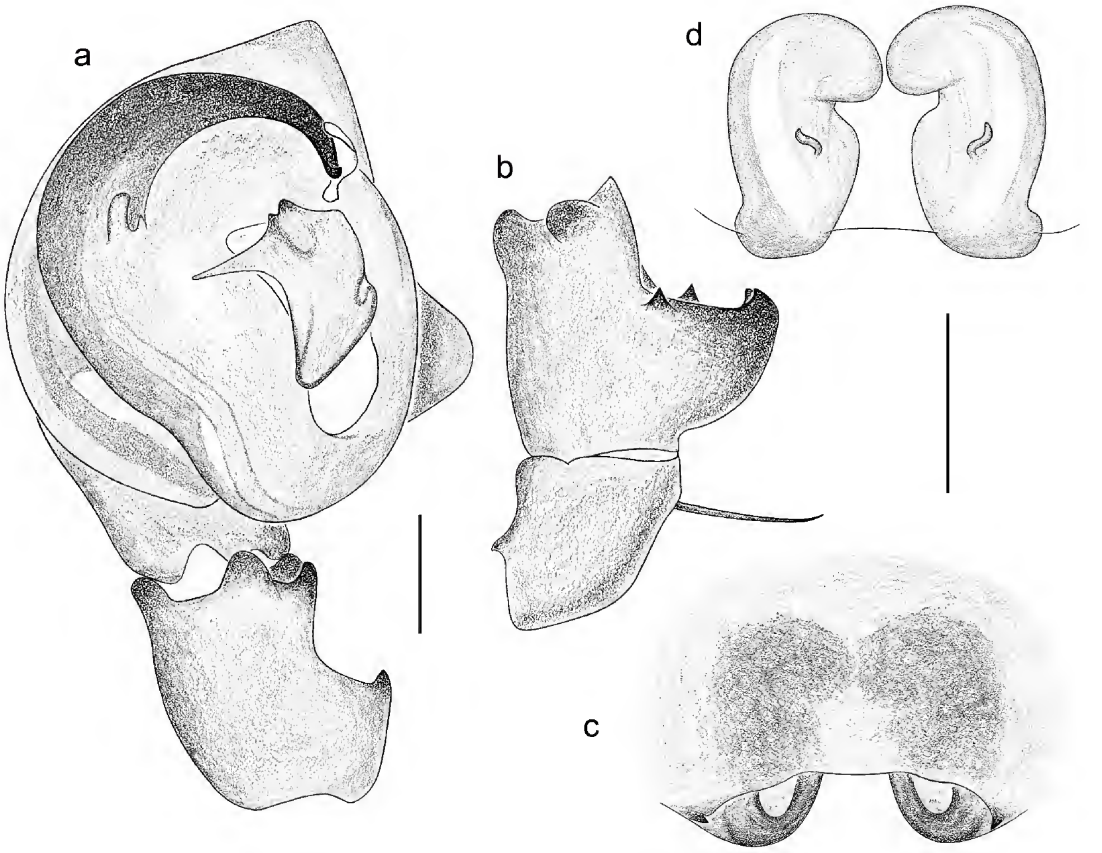

Fig. 21. *Storenosoma smithae. (a–b)* male palp (ANIC, NSW, Mt Clarke, Mar 2005): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia (ANIC, NSW, Mt Clarke, Mar 2004): *(c)* epigynum, ventral; *(d)* internal. Scale lines 0.25 mm.

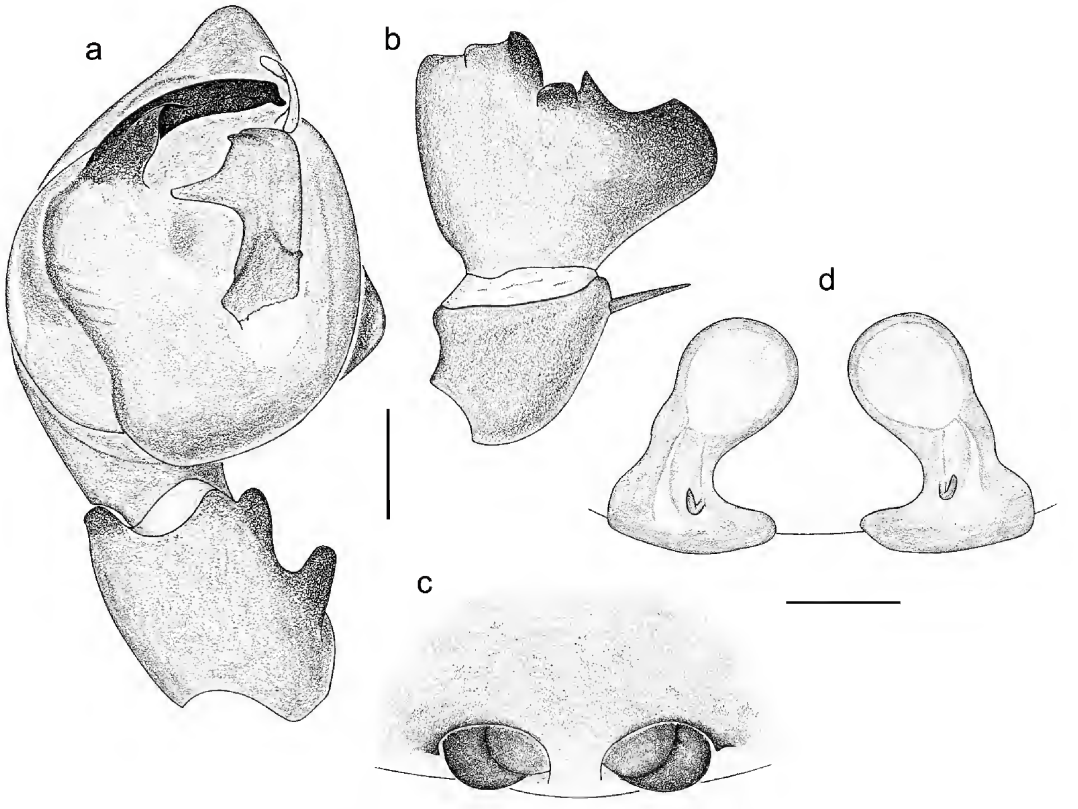

Fig. 22. *Storenosoma supernum. (a–b)* male palp (S30794): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (S30788); *(d)* internal (S1381). Scale lines 0.25 mm.

slender prolateral projection but no other pronounced projections. Embolus with basal expansion and pointed tip. Palpal patella with one dorsal spine, palpal tibia with one stout dorsal hair. Female epigynum (Figs 22c–d) with very small lateral teeth. Tarsal organ capsulate, situated distally to trichobothria.

Description. *Male*. Measurements: BL 6.10, CL 3.10, CW 2.52, PLE 0.32, PME 0.21, (QM S 1379). *Female*. Measurements: BL 6.50, CL 3.40, CW 2.38, PLE 0.32, PME 0.21 (QM S 1378). For morphological description see species diagnosis and generic description.

Distribution. Known from south east Queensland and north east New South Wales (Fig 27a)

Remarks. The female holotype has the epigynum plugged.

Storenosoma tasmaniensis, n.sp.

Figs 8c,g, 23a–b, 27a

Type material. HOLOTYPE ♂, Plateau Rd, Tasman Penninsula, 43°02'48"S 147°54'30"E, 25 Feb 1990, G. Cassis & I. Pegler (AMS KS69668). PARATYPES: 2♂, 2♀, same data as holotype (AMS KS69666). 1♀, Sandspit River, 42°42'S 147°51'E, 25 Feb 1990, G. Cassis (AMS KS69667).

Other material examined. TASMANIA: 1♀, Cascades, 6 Nov 1943 V.V. Hickman (S 46469): 1♀, Mt Wellington, 23 Jul 1943, V.V. Hickman (S 46467). 1♀, same data (S 46468) (all QM). 6♂, Warra, 43°05'S 146°41'E, site 663, 25 Sep 1997, D. Bashford. 4♂1♀, same data except site 338. 2♂1♀, same data except site 147. 7♂2♀, same data except site 254. 2♂, same data except site 59. 2♂, same data except site 60. 1♂, same data except site 70, 7 Nov 1997. 2♂1♀, same data except site 226. 4♂1♀, same data except site 254. 4♂1♀, same data except site 147. 2♂, same data except site 338. 2♂, same data except site 59. 2♂, same data except site 60. 3♂, same data except site 663. (all QVM). 1♀, ca 6 km SE of Tombs Lake, 42°16'19"S 147°51'36"E, 1 Jun 1972, J.L. Hickman (KS107523). 1♂1♀, same data (KS107559). 1♂, same data (KS107561) (all AMS).

Diagnosis. Male palp (Figs 23a–b) with TA reduced to stout hump below base of embolus. MA compact with slender prolateral projection but no other pronounced projections. Embolus with basal expansion and pointed tip. Palpal patella with one dorsal spine, palpal tibia without spines. Tarsal organ capsulate (Fig. 8c,g), situated distally of trichobothria.

Description. *Male*. Measurements: BL 6.20, CL 3.20, CW 2.65, PLE 0.36, PME 0.26 (AMS KS69668). *Female*. Measurements: BL 8.35, CL 4.10, CW 2.85, PLE 0.36, PME 0.26, (AMS KS69666). For morphological description see species diagnosis and generic description.

Etymology. The specific name refers to the type locality.

Distribution. Known only from southeastern Tasmania (Fig. 27a).

Remarks. The female specimens attributed to this species all have the epigynum plugged making the morphology unclear. For this reason it has not been illustrated. Since no other species of *Storenosoma* is known from Tasmania, it is presumed they are *S. tasmaniensis*.

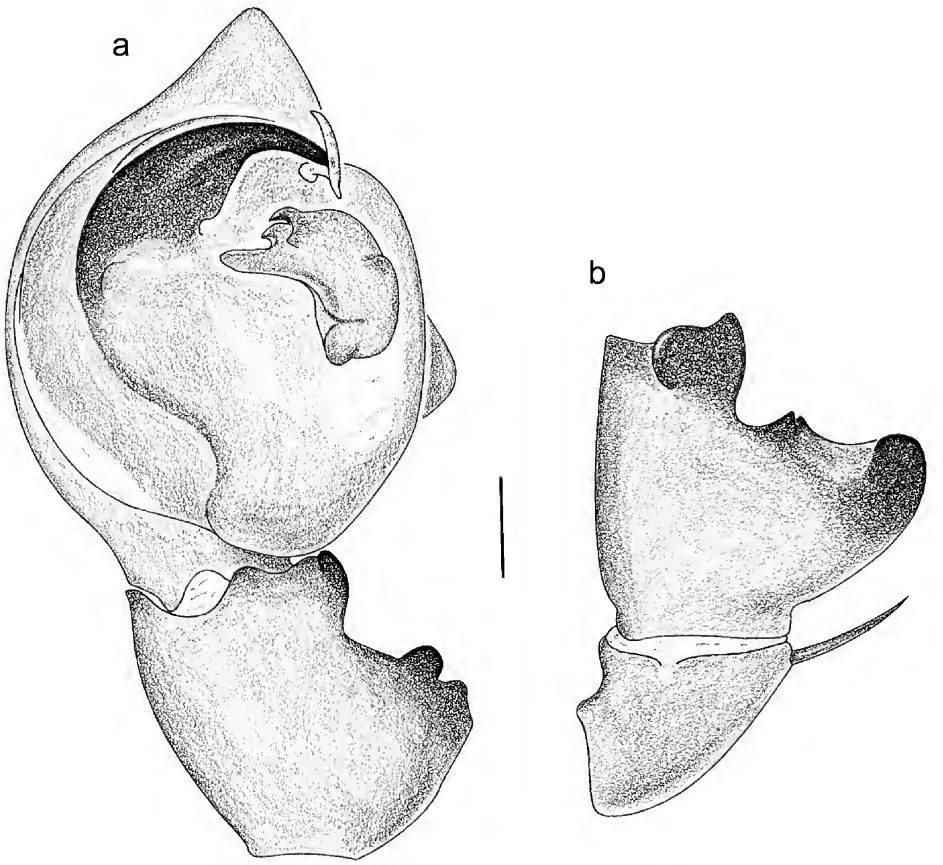

Fig. 23. *Storenosoma tasmaniensis*. *(a–b)* male palp (KS69666): *(a)* ventral; *(b)* RTA, retrolateral. Scale line 0.25 mm.

Storenosoma terraneum Davies

Figs 24a–d, 27d

Storenosoma terranea Davies, 1986: 240, figs 16–19, 32–35, 40–41. Species of *Storenosoma* described by Davies were emended by Platnick, i.e. *alta, superna, terranea* became *altum, supernum* and *terraneum*. See *World Spider Catalog* (version 11.5, Platnick, 2011).

Type material. HOLOTYPE ♀, Queensland, Binna Burra, 860 m, [28°12'S 153°11'E], Lamington National Park, litter, 10 Jul 1977, R. Raven (QM S1372). PARATYPES: 1♀, same data as holotype except 22 Jun 1973 (QM S1376); 1♂, same data except 10 Jul 1977 (QM S1373).

Other material. AUSTRALIAN CAPITAL TERRITORY: 3♂, 1♀, Lees Creek, Brindabella Range, 35°27'S 148°46'E, 27 Oct 1919, C. Dickman (KS13558). 1♀, Tidbinbilla Nature Reserve, 35°28'S 148°52'E, 9 Mar 1978, P. Ormay (KS13844). 4♀, same data (KS13883). 1♀, same data (KS13835). 1♀, same data (KS13836) (all AMS). 2♂, Blundells Ck., 3 km E of Picadilly Circus, 35°22'S 148°50'E, Aug 1984, Weir, Lawrence & Johnson. 1♀, same data except Apr 1985. 1♀, same data except May 1985. 1♂, same data except Jun 1985. 1♂, same data except Jul 1985. 1♂, same data except Sep 1985. 1♂, same data except Oct 1985. 1♂, Wombat Ck., 6 km NE of Picadilly Circus, 35°19'S 148°51'E, Jun 1985, Weir, Lawrence & Johnson. 1♂, same data except Aug 1985 (all ANIC).

QUEENSLAND: 1♀, Lamington NP (O'Reilly's), 28°14'S 153°08'E, 22–27 Nov 1978, Lawrence & Weir (ANIC). 1♂, Mt Asplenium, 28°09'S 152°26'E, 20 Dec 1992–Mar 1993, GBM (S 27465). 40♂, 7♀, same data (S 46472). 1♀, Bald Mountain, via Emu Vale, [28°14'S 152°25'E], 18 Aug–17 Nov 1974, GBM & SRM (S 30765). 1♂, same data except 28 Dec 1974–30 Mar 1975, GBM (S 30796). 1♂, Bare Rock, 2 km N of Mt Cordeaux, 28°02'S 152°23'E, 31 Dec 1993–20 Feb 1994, 1100 m, GBM (S 46477). 1♂, Cunnighams Gap, [28°03'S 152°24'E], 17 Nov–28 Dec 1974, GBM & SRM (S 30763). 1♂, same data except 7 Oct–17 Nov 1974 (S 30761). 1♂, Mt Huntly, 28°08'S 152°26'E, 20 Dec 1992–Mar 1993, 1260 m, GBM (S 46474). 13♂, 2♀, same data (S 46473). 1♀, Mistake Mountains, via Goomburra, [27°55'S 152°20'E], 10 Oct 1976–9 Jan 1977, GBM & SRM (S 30740). 5♂, 1♀, same data (S 30738). 1♂, 1♀, same data (S 29760). 1♀, same data except 9 Jan–13 Feb 1977 (S 30784). 1♀, same data (S 29762). 6♂, 2♀, same data except 13 Feb–13 Oct 1977 (S 30782). 1♂, 1♀, same data (S 29761). 1♂, 1♀, Nothofagus Mountain, [28°17'S 152°37'E], 1981–1982, GBM (S 7015). 1♂, O'Reilly's Guest House, Lamington National Park, [28°14'S 153°08'E], 1 Oct 1980–18 Nov 1980 (S 16415). 2♀, same data except 24–26 Sep 1986, RR & J. Gallon (S 30756). 2♀, same data except 27 Dec 1981, Monteith *et al.* (S 30748). 1♀, same data except 11 Apr–12 Sep 1976, GBM & SRM (S 30791). 1♂, same data (S 30799). 1♂, Plateau south of The Head, via Killarney, 27 Dec 1974–31 Mar 1975, GBM & SRM (S 29763). 2♂, same data except 31 Mar–2 Aug 1975 (S 30766). 2♂, same data except 17 Nov–27 Dec 1974, GBM (S 30792). 3♂, 2♀, Mt Superbus, [28°14'S 152°28'E], 12 Mar–13 Apr 1989, RR & T. Churchill (S 16576). 1♂, 2♀, same data except 12 Mar–13 Apr 1990 (S 15913). 1♂, same data (S 15888). 1♀, same data except 9 Feb 1990, T. Churchill (S 16613).1♀, same data except 12 Mar–13 Jun 1990, T. Churchill & RR (S 16565). 3♂, 1♀, base of Mt Superbus, [28°14'S 152°28'E], 24 Apr 1991, T. Churchill (S 25225). 2♂, Teviot Falls, via Boonah, [28°14'S 152°29'E], 8 May–15 Aug 1976, GBM & SRM (S 30780). 2♂, same data (S 30795). 2♂, same data except 5 Oct 1975–22 Feb 1976 (S 30769). 2♀, same data (S 30793). 1♂, same data except 15 Aug–3 Oct 1976 (S 30770) (all QM).

NEW SOUTH WALES: 4♂, Acacia Plateau and Wilsons Peak area, Koreelah State Forest, 28°16'S 152°27'E, 11 Dec 1988, Smith, Hines, Pugh & Webber (KS51391). 1♂, same data (KS51311). 1♂, same data (KS55344). 1♂, same data (KS69785). 5♂, 1♀, same data (KS51288). 1♂, same data (KS53288). 1♂, same data (KS52403). 3♂, same data (KS52402). 2♂, same data (KS49093). 4♂, same data (KS69823). 1♂, Barren Grounds Nature Reserve, 14 km NNW of Jamberoo, 34°40'28"S 150°42'45"E, 16–20 Jun 1999, L. Gibson (KS69773). 1♂, 1♀, same data except 21–25 Jun 1999 (KS69774). 1♂, same data except 11–15 Feb 1999 (KS69770). 1♂, same data except 11–15 Aug 1999 (KS69787). 1♂, same data except 16–20 Aug 1999 (KS69769). 3♂, same data except 1–5 Jun 1999 (KS69771). 1♂, same data except 11–15 Jun 1999 (KS69772). 2♂, same data except 16–20 Dec 1998 (KS69775). 1♂, same data except 6–10 Dec 1998 (KS63090). 1♂, same data except 11–15 Dec 1998 (KS69768). 2♂, 3♀, same data except 16–20 Dec 1999 (KS69786). 1♂, 3♀, Benandarah State Forest, 8 km N of Batemans Bay, 35°40'S 150°14'E, 19 Oct 1978, C. Horseman (KS2035). 1♂, 1♀, same data except 24 Aug 1978 (KS1743). 1♀, same data except 16 Dec 1978 (KS2272). 2♂, same data except 13 Jan 1979 (KS2476). 1♀, same data except 31 May 1979 (KS3124). 1♂, same data except 28 Jun 1979 (KS3362). 1♂, same data except 26 Jul 1979 (KS3867). 1♂, same data except 21 Sep 1979 (KS3924). 5♀, same data except 7 km N of Batemans Bay, 35°39'S 150°14'E (KS1502). 1♂, Beaury State Forest, Tooloom Scrub, 28°35'S 152°22'E, 12 Dec 1988, Smith, Hines, Pugh & Webber (KS50961). 1♂, same data (KS50960). 1♂, same data (KS51061). 3♂, same data (KS51013). 1♀, same data (KS51268). 1♀, same data (KS52404). 1♂, Beecroft, 33°45'S 151°04'E, 1 Oct 1999, J. Noble (KS69779). 1♂, Beecroft Peninsula, northern headland of Jervis Bay, 35°03'03"S 150°47'21"E, 21–25 Aug 1999, L. Gibson (KS69778). 1♂, same data except 1–5 Aug 1999 (KS69777). 1♂, Blue Mountains, 33°36'S 150°15'E, Feb 1932, K. Spence (KS16506). 1♂, Blue Mountains N.P., Binnowee Drive, 33°40'15"S 150°27'55"E, 15 Aug 1996, AMS KS53286. 1♀, Bondi State Forest, S of Bombala, 37°08'S 149°09'E, 15 Oct 1980, G. Gowing (KS11223). 1♂, 1♀, same data (KS11295). 1♀ same data (KS11287). 1♀, same data (KS11330). 1♂, same data (KS69896). 2♂, same data except 25 Oct 1980 (KS11071). 1♂, same data (KS11084). 1♂, same data (KS11096). 1♂, same data (KS11107). 1♀, same data (KS11121). 1♂, same data (KS11113). 1♂, 1♀, same data (KS69895). 1♂, same data except 14 Nov 1980 (KS11870). 1♂, same data (KS11920). 1♂, same data (KS11930). 1♂, same data (KS11954). 1♂, 1♀, same data (KS11964). 1♂, same data (KS11971). 1♂, same data (KS11986). 1♀, same data (KS12019). 1♂, same data except 6 May 1980 (KS12188). 1♂, same data except 3 Aug 1980 (KS55349). 1♂, same data (KS69821). 2♂, 1♀, Bondo State Forest, 35°39'S 148°15'E, 20 Dec 1980, (KS45446). 1♂, Booderee National Park, south headland of Jervis Bay, 35°08'49"S 150°45'05"E, 11–15 Aug 1999, L. Gibson (KS69776). 1♂, 1♀, Mt Boss State Forest, 31°12'S 152°24'E, Oct 1980, G. Webb (KS42826). 5♂, same data except (Sth Plateau) (KS42890). 1♂, same data except (Kota) (KS43500). 1♀, Mt Boss State Forest, North Plateau Rd at Plateau Beech Picnic Area, 31°10'S 152°19'E, 4 Feb–9 Apr 1993, MRG & GC (KS42544). 1♀, same data (KS42541). 1♀, same data (KS42542). 1♀, same data (KS42543). 2♀, Mt Boss State Forest, North Plateau Rd, 1.5 km from Plateau Beech Picnic Area, 31°10'S 152°19'E, 4 Feb–9 Apr 1993, MRG & GC (KS42545). 1♀, Mt Boss State Forest, Rimau Rd, 31°11'S 152°21'E, 4 Feb–9 Apr 1993, MRG & GC (KS42547). 1♀, Brown Mountain, west of Bemboka, 36°36'S 149°23'E, 16 Apr 1978, MRG (KS48993). 1♂, 4♀, Bulga State Forest, Pole Bridge Rd, 0.5 km E of Knodingbul Rd, 31°37'S 152°09'E, 4 Feb–9 Apr 1993, MRG & GC (KS40806). 1♀, Bulga State Forest, Bobbin Fire Trail, 0.1 km from Padman's Rd, 31°37'S 152°10'E, 4 Feb–9 Apr 1993, MRG & GC (KS40803). 1♂, Bungonia Caves area, near Information Centre, 34°50'S 150°04'E, Nov 1989, G. Hunt (KS22553). 1♂, Bungonia Caves, B15–B4 extension, 34°50'S 150°00'E, 14 Jul 1979, G. Smith (KS19061). 1♂, Bungonia, Hogans Hole B5, 34°50'S 150°04'E, 15 Jan 1977, D. Rothery (KS644). 5♀, Chichester State Forest, Karuah River Rd, 1.8 km N of ford on Karuah River, 32°05'S 151°43'E, Feb 1993, MRG & GC (KS41332). 3♀, same data except 2.3 km N of Karuah River (KS41374). 1♀, Chichester State Forest, Allyn River Forest Rd, 0.5 km S of Mt Allyn Rd, 32°09'S 151°28'E, 4 Feb–9 Apr 1993, MRG & GC (KS41367). 4♀, Chichester State Forest, Mt Allyn Rd, 2.3 km N of Shellbrook Forest Rd, 32°08'S 151°27'E, 4 Feb–9 Apr 1993, MRG & GC (KS41371). 1♀, same data (KS41372). 1♀, Chichester State Forest, Mt Allyn Rd, 0.3 km E of Shellbrook Forest Rd, 32°09'S 151°27'E, 4 Feb–9 Apr 1993, MRG & GC (KS41373). 2♀, same data except 0.8 km N of Shellbrook Forest Rd (KS41377). 1♂, Christophersons Mountain, 2 km SSW of Bostobrick, 30°17'45"S 152°37'04"E, 9–23 Nov 1999, MRG, GAM & H. Smith (KS69781). 1♂, 32 km E of Cooma, Wadbilliga NP, Tuross Falls, 2.8 km from Peter Rd turnoff, 36°11'58"S 149°30'12"E, 24 Oct 2006, C. Car (KS107212). 2♂, 15 km SE of Countegany, Two River Plain, Wadbilliga Trail NP, 36°17'50"S 149°32'32"E, 24 Oct 2006, C. Car (KS105591). 3♀, Dome Mountain, Richmond Range & Yabbra SF, 28°28'S 152°43'E, 11 Dec 1988, Smith, Hines, Pugh & Webber (KS55347). 1♂, same data (KS69784). 2♂, 2♀, Enfield State Forest, Mummel Forest Rd, 7.6 km N of junction with Enfield Forest Rd, 31°17'S 151°51'E, 4 Feb–9 Apr 1993, MRG & GC (KS40812). 2♀, same data except 6.1 km N of junction with Enfield Rd (KS40815). 1♀, same data (KS69891). 1♂, 3♀, Enfield State Forest, Dodd's Fire Trail, 2 km from Enfield Rd on Scrubby Ck, 31°23'S 151°52'E, 4 Feb–9 Apr 1993, MRG & GC (KS40816). 1♀, Ewingar State Forest, Elkhorn Rd, 29°06'S 152°26'E, 4 Feb–9 Apr 1993 MRG & GC (KS42524). 1♀, Ewingar State Forest, Nogrigar Rd, 29°08'S 152°25'E, 4 Feb–9 Apr 1993 MRG & GC (KS69894). 1♂, Grill Cave B44–1, Bungonia, 34°50'S 150°00'E, 14 May 1993, E. Eberhard (KS37496). 1♂, Hazelbrook, Railway Parade, 33°43'55"S 150°27'00"E, 3 Oct 1996, AMS KS53285. 1♂, same data (KS52405). 2♀, Mt Hyland Nature Reserve, Obeloe Ck, 2 km SW on Obeloe Rd from Chaelundi Rd, 30°09'S 152°27'E, 4 Feb–9 Apr 1993, MRG & GC (KS35247). 1♂, Illawong, Sproule St., 36°00'S 148°40'E, R. Lowson (KS53287). 1♂, 1♀, Jamberoo Mountain, via Kiama, 34°40'S 150°43'E, 8 Nov 1987, G. Hunt (KS18424). 1♂, Jamberoo Mountain, 34°40'S 150°43'E, 20 Jun 1994, J.

Noble (KS53614). 1♂, same data except 20 Dec 1996 (KS53613). 4♂, Jenolan Caves Area, Southern Limestone Area, 33°49'S 150°02'E, 6 Jul 1989, G. Hunt (KS21669). 6♂, same data except 14 Aug 1989 (KS22525). 1♂, Jenolan Caves Area, Playing Fields, 33°49'S 150°02'E, 14 Aug 1989, G. Hunt (KS22520). 2♀, Kanangra-Boyd National Park, Boyd Plateau, near Jenolan Caves, 33°59'S 150°08'E, 25 Apr 1971, G. Hunt (KS30025). 2♂, same data except 8 Jun 1971 (KS1393). 1♂, 2♀, Kanangra-Boyd National Park, Mt. Edwards, 33°50'S 150°00'E, 15 May 1971, MG (KS1390). 2♂, Mt Keira Fauna Reserve, scout camp, 34°24'S 150°51'E, 19 Oct 1978, CH (KS2006). 2♂, same data except 16 Nov 1978 (KS2088). 1♂, same data (KS2087). 1♀, same data except 17 Feb 1978 (KS1463). 1♀, same data except 14 Mar 1978 (KS1458). 1♀, same data except 8 Apr 1978 (KS1537). 1♂, same data except 30 Apr 1978 (KS1403). 1♂, same data (KS1409). 1 m, same data except 30 May 1978 (KS1484). 1♂, 1♀, same data except 30 Jun 1978 (KS1585). 1♂, same data except 28 Jul 1978, MG (KS1643). 2♂, same data except 6 Dec 1978, CH (KS2172). 1♀, same data (KS2246). 2♂, same data (KS2185). 2♂, same data (KS2195). 3♂, same data (KS2207). 4♂, 1♀, same data (KS2220). 1♂, same data (KS2221). 2♂, same data (KS2234). 2♂, same data (KS2235). 5♂, 1♀, same data (KS2247). 5♂, same data except 3 Jan 1979 (KS2365). 5♂, 1♀, same data (KS2380). 1♂, 1♀ same data (KS2381). 5♂, same data (KS2396). 7♂, 3♀, same data (KS2398). 1♂, 1♀, same data (KS2407). 4♂, same data (KS2408). 16♂, 2♀, same data (KS2419). 3♂, same data except 31 Jan 1979 (KS2516). 1♂, same data (KS2528). 4♂, same data (KS2535). 2♂, 1♀, same data (KS2538). 6♂, 1f, same data (KS2547). 3♂, 1♀, same data (KS2560). 7♂, same data (KS2572). 1♂, same data except 28 Mar 1979 (KS2842). 1♀, same data (KS2858). 4♂, same data except 31 May 1979 (KS3091). 1♀, Kerewong State Forest, near Lorne, site 108, 31°36'S 152°34'E, 15 Jul 1979, D. Milledge, (KS5406). 4♂, 2♀, same data (KS5428). 4♂, same data (KS5441). 3♂, 1♀, same data (KS5463). 10♂, 2♀, same data except 28 May 1978 (KS1554). 1 m, same data except 18 Oct 1978 (KS16113). 2♀, same data except 20 Nov 1978 (KS16137). 1♀, same data (KS16190). 4♂, 1♀, same data except site 111.2, 31°35'S 152°41'E, 29 Aug 1978 (KS1983). 10♂, Kioloa State Forest, Forest Drive, 16 km N of Batemans Bay, 35°36'S 150°16'E, 19 Oct 1978, CH (KS2017). 2♂, 1♀ same data except 16 Dec 1978 (KS2309). 1♀, same data except 13 Jan 1979 (KS2450). 7♂, 6♀, same data except 18 km N of Batemans Bay (KS2305). 7♂, 1f, Kioloa State Forest, Forest Drive, 35°37'S 150°16'E, 16 Nov 1978, CH (KS2111). 1♀, same data except 3 Mar 1979 (KS2809). 3♂, same data (KS2112). 5♂, 1♀, same data except 28 Jun 1979 (KS3835). 4♂, same data except 23 Aug 1979 (KS4550). 5♂, 1♀, same data except 15 km N of Batemans Bay, 13 Jan 1979 (KS2463). 2♀, same data except 11 Feb 1979 (KS2588). 1♂, same data except 9 Apr 1979 (KS2906). 3♂, 1♀, same data except 31 May 1979 (KS3114). 3♂, 2♀, same data except 26 Jul 1979 (KS3859). 4♂, 1♀, same data except 21 Sep 1979 (KS3903). 1♂, same data except 17 Oct 1979 (KS5500). 2♂, same data (KS5545). 2♂, 2♀, same data except 14 km N of Batemans Bay, 21 Aug 1978 (KS1948). 8♂, 1♀, same data except 8 km N of Batemans Bay, 3 May 1979 (KS3009). 3♂, 2♀, Kioloa State Forest, rest area, 35°36'S 150°15'E, 16 Nov 1978, CH (KS2099). 2♀, same data except 8 Mar 1979 (KS2803). 1♀, same data except 9 Apr 1979 (KS2901). 1♂, same data except 31 Apr 1979 (KS3107). 2♂, same data except 28 Aug 1978 (KS1737). 1♂, Same data except 28 Jul 1978, MG (KS1649). 1♂, same data except 13 Jul 1978 (KS46065). 3♂, Koreelah State Forest, Acacia Plateau & Wilsons Peak area, 28°16'S 152°27'E, 11 Dec 1988, Smith *et al.* (KS44116). 1♂, 1♀, same data (KS44123). 1♂, same data (KS50400). 1♂, same data (KS43897). 1♀, Kurrawong, near Pittwater, 33°39'S 151°17'E, 13 Jun 1965, R. Mascord (KS1534). 1♀, Lorne State Forest, near Lorne, 31°35'S 152°57'E, 4 Nov 1979, D. Milledge (KS5655). 2♂, 3♀, Minnamurra Falls, 34°38'S 150°51'E, 11 Oct 1978, G. Wishart (KS29723). 1♀, Mountain Trail, 2.1 km S of junction with Kunungra Rd, 32°08'S 151°45'E, 4 Feb–9 Apr 1993, MG & GC (KS42526). 4♀, same data except 0.8 km S (KS42527). 2♀, Nadgee Nature Reserve, 37°27'S 149°56'E, 24 May 1978, G. Gowing (KS1598). 1♀, New England National Park & Styx River State Forest border, 3 km S of Point Lookout, 30°31'S 152°23'E, 4 Feb–9 Apr 1993, MRG & GC (KS35283). 1♂, 10 km SE of Nimmitabel, Glen Bog SF, 36°36'46"S 149°22'07"E, 24 Oct 2006, C. Car (KS107211). 1♂, same data except 14 Jun 2006 (KS105549). 1♀, southwest of Nowra, 34°53'S 150°36'E, 11 Mar 1990, G, Hunt (KS22711). 7♂3♀, Royal National Park, Lady Wakehurst Drive, beside Hacking River, 34°09'47"S 151°00'55"E, 6–20 Dec 1999, MRG, GAM & H. Smith (KS63220). 1♂, Royal National Park, Upper Causeway, 34°08'S 151°04'E, 25 Aug 1988, M. Zabka *et al.* (KS27936). 1♀, same data except 23 Mar 1990, CH & J. Thompson (KS23658). 1♂, "Scalloway", Willowvale, near Gerringong, 34°45'S 150°50'E, Nov 1979, G. Wishart (KS4311). 3♂, 1♀,

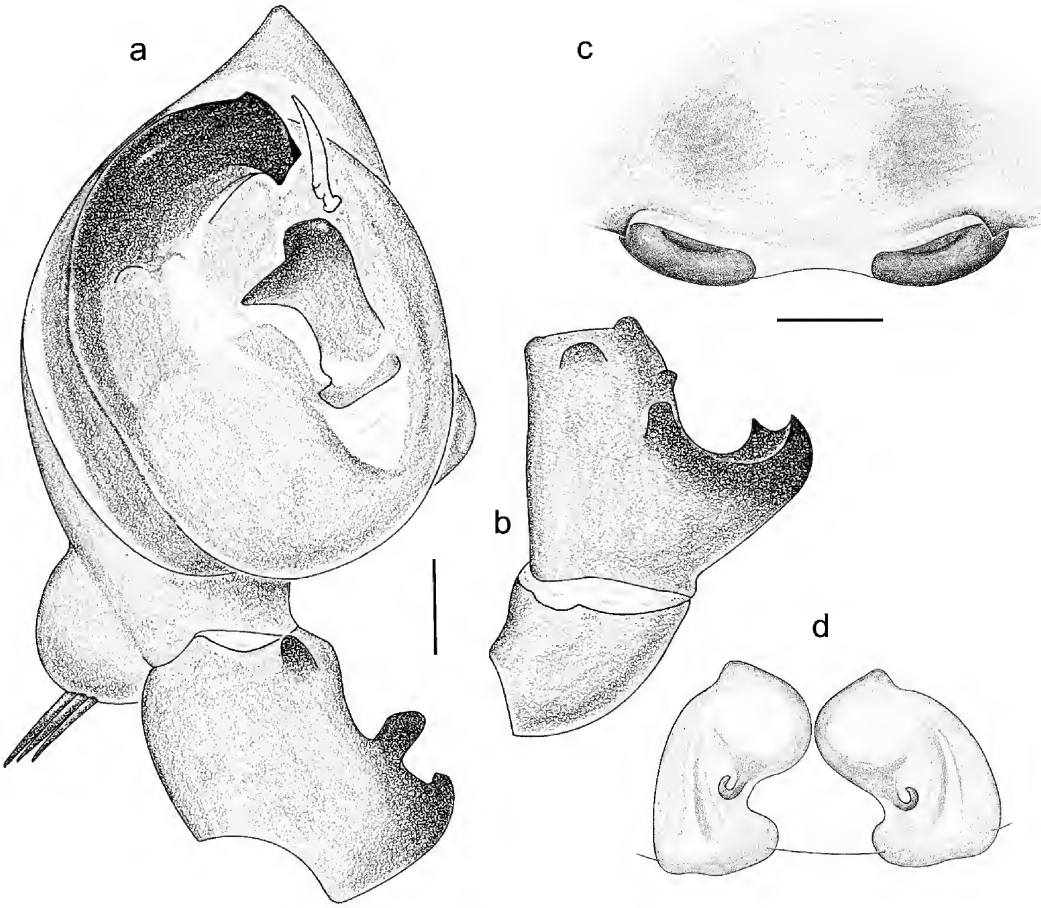

Fig. 24. *Storenosoma terraneum. (a–b)* male palp (S7015): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (S15913); *(d)* internal (KS42542). Scale lines 0.25 mm.

same data except 3 May 1986 (KS17401). 1♂, same data except May 1987 (KS30238). 1♀, same data except 26 Jul 1986 (KS17402). 1♀, same data except 30 Oct 1986 (KS17427). 1♂, Tooloom Scrub Forest Reserve, Legume Rd, nr Urbenville, 10–11 Jan 1988, D.J. Bickel (KS69788). 3♂, "Tuglo", 48 km N of Singleton, 32°15'S 151°20'E, Jan 1977, MRG (KS44938). 1♀, Tweed Range, 28°25'S 153°02'E, 16 Feb 1989, Smith, Hines, Pugh & Webber (KS51258). 1♂, same data (KS48909). 1♂, Wahroonga Fox Valley Reserve, 33°42'S 151°08'E, 17 Nov 1979, B. Henke (KS5609). 1♀, Mt Werong, via Oberon, 34°05'S 149°56'E, 3 Jul 1972, G. Hunt (KS44940). 1♂, Mt. Wilson, Blue Mountains, 33°30'S 150°23'E, 14 Apr 1959, D.F. McMichael (KS52401). 1♂, Mt Wilson, Cathedral of Ferns area, 33°30'S 150°23'E, 1 Nov 1978, MRG & CH (KS2045). 1♂, 1♀, same data except 28 Nov 1978, CH (KS2141). 1♀, same data except 21 Jan 1979 (KS2634). 1♂, same data except 26 Dec 1978 (KS2351). 1♂, same data except 18 Apr 1979 (KS2936). 1♀, same data except 16 May 1979 (3028). 1♂, same data except 17 Jun 1979 (KS3818). 1♂, same data except 20 Apr 1978 (KS1470). 1♂, same data except 20 May 1978 (KS1475). 2♂, same data except 16 Jun 1978 (KS1542). 2♂, same data except 7 Sep 1978 (KS1760). 1♀, same data except 21 Sep 1978 (KS1960). 3♀, same data except Feb 1978 (KS1351). 19♂, 2♀, Mt Wilson, Waterfall Picnic Area, 33°30'S 150°23'E, 28 Nov 1978, CH (KS2153). 1♀, same data except 15 Nov 1978 (KS2056). 1♀, same data except 26 Dec 1978 (KS2335). 9♂, 1♀, same data (KS2337). 3♀, same data except 28 Mar 1979 (KS2823). 5♂, 2♀, same data except 18 Apr 1979. 5♂, same data except 16 May 1979 (KS3020). 7♂, same data except 17 Jun 1979 (KS3135). 2♂, same data except 17 Jul 1979 (KS3844). 3♂, same data except 29 Nov 1979 (KS4322). 4♂, same data except 4 Oct 1979 (KS5481). 1♀, same data except 3 Nov 1979 (KS5577). 1♂, Woodford, Ridge St., 33°43'50"S 150°28'40"E, 30 Sep 1996, AMS KS52406. 1♀, Woronora Dam Catchment, Fire Rd no.9, 34°11'53"S 150°54'32"E, 8–22 Dec 1999, MRG, GAM & H. Smith (KS63225). 2♂, 1♀, Woronora Dam Catchment, Fire Rd no.9, 34°11'53"S 150°54'32"E, 26 Oct-14 Nov 2000, GAM & H. Smith (KS69362). 2♂, 1♀, Yabbra Scrub, Yabbra State Forest, 28°38'S 152°30'E, 14 Dec 1988, Smith, Hines, Pugh & Webber (KS51286). 4♂, 3♀, same data (KS55346). 1♂, same data (KS49857). 1♂, same data (KS69780). 4♀, same data (KS45733). 1♀, same data (KS48754). 2♀, same data. (KS49712). 2♀, same data. (KS55345). 2♀, same data. (KS69782). 1♂, 1♀, same data except 12 Dec 1988 (KS69822). 1♂, same data except 17–19 Nov 1989 (KS69783) (all AMS). 1♂1♀, Brown Mt, near Nimmitabel, Rutherford Ck., 26 May 1970, W.T. & R. Bartell. 1♂, Clyde Mt., 14 Apr 1970, E.F. Riek. 1♀, Clyde Mt., 35°33'S 149°57'E, 15 May 1984, R.B. Halliday & M.S. Harvey. 3♂1♀, 4 km E of Mt Wog Wog, 17 km SE of Bombala, 37°04'30"S 149°28'00"E, Jul 1986, C.R. Margules (all ANIC). 2♂, 5♀, Monga State Forest, 4 km from Monga, 30 km SW of Braidwood, 35°33'S 149°56'E, 8–20 Aug 1990, C.Griswold & T.Meikle (CAS). 1♂, 1♀, Barrington House, via Salisbury, 24–25 Jun 1987, RR & T. Churchill (S 13099). 1♂, Mt Clunie, [28°18'S 152°32'E], via Woodenbong, 8 Apr–15 Aug 1976, GBM & SRM (S 30797). 1♀, Gibraltar Range, 10 Nov 1980, RR (S 30744). 1♀, same data except GBM (S 30750). 1♂, same data except 30 Mar–10 Nov 1980 (S 30760). 1♂, 1♀, Lever's Flat, via Rathdowney, [28°20'S 152°52'E], 1 Nov 1975–14 Mar 1976, GBM & SRM (S 30788). 1♀, same data (S 30768). 1♀, same data except 22 May–8 Sep 1976 (S 30781) 3♂, same data (S 30785). 1♂, same data except 8 Sep–31 Oct 1976 (S 30786). 1♂, Tweed Lookout, Wiangaree, via Kyogle, [28°21'S 153°06'E], 16 Nov–27 Dec 1974, GBM. & SRM (S 30767). 1♂, same data except 18 Aug–16 Nov 1974 (S 30762) (QM). 1♂, 1♀, Monga, [35°35'S 149°55'E], Oct 1984, W. Osbourne (95/1186-7) (WAM).

VICTORIA: 1♂, 1♀, Alfred National Park, 37°32'S 149°20'E, 14 Apr 1978, MRG (KS45234). 1♀, Blue Range Rd., between Thornton & Rubicon, 37°21'S 145°53'E, 9 Apr 1978, MRG (KS45569) 1♂, Glen Wills area, 36°50'S 147°30'E, 13 Apr 1978, MRG (KS45571) (all AMS). 1♂, [East Gippsland], Cobon South forest coupe 513.04, 37°25'S 148°58'E, upslope site, 10–17 Nov 1991, RC (K 4121). 1♂, same data except midslope site (K 4122). 2♂, same data except gully site RC (K 4123). 1♀, same data except 5–12 Mar 1992 (K 4120). 1♂, 1♀ [East Gippsland], Cobon North forest coupe 507.06, 37°23'S 148°56'E, midslope site, 29 Apr to 6 May 1992, RC (K 4115). 2♀, same data except upslope site, 17–25 Mar 1992 (K 4111). 1♀, same data (K 4114). 4♂, [East Gippsland], Cobon North forest coupe 512.08, 37°22'S 148°56'E, gully site, 5–11 May 1992, RC (K 4116). 1♂, same data except upslope site (K 4118). 2♂, same data except gully site, 12–20 Dec 1991, RC (K 4117). 1♂, [East Gippsland], Cobon North forest coupe 513.03, 37°23'S 148°56'E, gully site, 23–29 Apr 1992, RC (K 4119). 1♀, [East Gippsland], Sardine forest coupe 513.02, 37°24'S 148°31'E, gully site, 23–30 Jan 1992, RC (K 4124). 3♀, same data except upslope site (K 4125). 1♂, [East Gippsland], Sardine forest coupe 513.03, 37°24'S 148°31'E, gully site, 27 Apr to 4 May 1992, RC (K 4126). 1♂, [East Gippsland], Sardine forest coupe 513.06, 37°24'S 148°31'E, midslope site, 31 May to 7 Jun 1992, RC (K 4127). 1♂, same data except gully site, 10–15 May 1992, RC (K 4128). 1♀, same data (K 4112). 1♂, [East Gippsland], Rich-Murrungowar forest coupe 509.06, 37°34'S 148°40'E, gully site, 28 Oct to 5 Nov 1991, RC (K 4129). 20♂, 3♀, DCE Upper Yarra site 6, 11 km NE of McMahons Creek, 37°39'S 145°56'E, 14–24 Nov 1988, L. Lumsden (K 4130). 9♂, DCE Upper Yarra site 7, 11.3 km ENE of McMahons Creek, 37°40'S 145°57'E, 14–24 Nov 1988, L. Lumsden (K 4131). 1♂, same data (K 4132) (all NMV). 1♂, Leongatha, 38°30'S 145°58'E, 13 Jun 1995, R.de Souza-Daw (N197333) (SAM).

Diagnosis. Male palp (Figs 24a–b) with TA reduced to small bump below base of embolus. MA compact with slender prolateral projection but no other pronounced projections. Embolus broad, abruptly narrowing to pointed tip, with small projection on distal edge before tip. Cymbium with basal prolateral swelling topped by two to four stout macrosetae, adjacent row of stout hairs bordering retrolateral basal depression of cymbium. Palpal patella with single stout dorsal hair, palpal tibia without spines. Female epigynum (Figs 24c–d) with small lateral teeth. Tarsal organ capsulate, situated distally of trichobothria.

Description. *Male*. Measurements: BL 7.60, CL 4.35, CW 3.30, PLE 0.35, PME 0.30 (QM 1373). *Female*. Measurements: BL 11.70, CL 4.75, CW 3.75, PLE 0.40, PME 0.35 (QM S1372). For morphological description see species diagnosis and generic description.

Distribution. Known from south east Queensland to south east Victoria (Fig. 27d). This is the most widely distributed species of *Storenosoma*.

Remarks. The female holotype has the epigynum plugged.

Storenosoma victoria n.sp.

Figs 8d,h, 25a–d, 27b

Type material. HOLOTYPE ♂, Victoria, Cement Creek, 37°42'S 145°44'E, 2 Jul 1994, D. Bickel (AMS KS44941). PARATYPES: 3♂, 4♀, Blackwarri Scenic Rd., 0.5 km S of Blackwarri, 38°24'S 146°37'E, 11 Apr 1978 MRG (AMS KS45290); 1♂, Central Highlands, Cement Creek Reserve, 2.2 km ESE of Mt Donna Buang, 37°43'S 145°42'15"E, 20 Jun–1 Sep 1995, GAM, (NMV K4161); 1♀, same data (NMV K4159).

Other material. VICTORIA: 1♀, Kinglake National Park, 37°35'S 145°20'E, 29 Mar 1978 MRG (KS45895). 1♂, Strzelecki State Forest, 38°29'S 146°41'E, 11 Apr 1978, MRG (KS45617). 1♀, Mt Worth State Park, near Seaview, 38°16'S 145°59'E, 23 Mar 1978, MRG (KS45282). 2♂, Otway Ranges, 38°27'S 143°58'E, Aug 1979, A. Frazer (KS4393) (all AMS). 38♂, Central Highlands, Acheron Gap, 6 km NE of Mt Donna Buang, 37°40'43"S 145°44'20"E, 26 Oct–28 Dec 1995, GAM, (K 4135). 4♀, same data (K 4134). 2♀, same data (K 4133). 8♂, same data except 28 Dec 1995–21 Feb 1996 (K 4136). 1♀, same data (K 4137). 6♂, same data except 23 Apr–25 Jun 1996 (K 4138). 1♀, same data (K 4101). 16♂, Central Highlands, 0.7 km N of Acheron Gap, 7 km NE of Mt Donna Buang, 37°40'17"S 145°44'20"E, 26 Oct–28 Dec 1995, GAM, (K 4141). 1♀, same data (K 4140). 1♂, same data (K 4142). 1♀, same data (K 4143). 10♂, same data except 28 Dec 1995–21 Feb 1996 (K 4144). 2♂, same data except 23 Apr–25 Jun 1996 (K 4145). 23♂, Central Highlands, the Big Culvert, 2.5 km ENE of Mt Observation, 37°33'36"S 145°52'15"E, 26 Oct–28 Dec 1995, GAM, (K 4148). 1♂, Same data (K 4146). 4♀, same data (K 4147). 2♂, same data except, 28 Dec 1995–21 Feb 1996 (K 4149). 1♀, same data except 19 Feb 1996 (K 4150). 1♂, same data except, 21 Feb–23 Apr 1996 (K 4152). 4♀, same data (K 4145). 6♂, same data except, 23 Apr–25 Jun 1996 (K 4154). 6♀, same data (K 4153). 11♂, Central Highlands, Cement Creek Reserve, 2.2 km ESE of Mt Donna Buang, 37°43'S 145°42'15"E, 29 Nov 1994–20 Jan 1995, GAM, (K 4155). 1♀, same data except 21 Jan–7 Apr 1995 (K 4156). 2♀, same data except 7 Apr–16 May 1995 (K 4157). 1♀, same data except 16 May–15 Jun 1996 (K 4158). 8♂, same data except 20 Jun–1 Sep 1995 (K 4160). 6♂, Central Highlands, Donna Buang Rd, 1 km SW of Mt Donna Buang, 37°43'S 145°40'15"E, 29 Nov 1994–20 Jan 1995, GAM (K 4162). 9♂, same data except 21 Jan–7 Apr 1995 (K 4164). 1♀, same data (K 4163). 14♂, same

data except 7 Apr–16 May 1995 (K 4166). 1♀, same data (K 4165). 26♂, Central Highlands, Myrtle Gully Reserve, 3.4 km WSW of Mt Donna Buang, 37°43'S 145°38'30"E, 29 Nov 1994–20 Jan 1995, GAM (K 4170). 1♂, same data (K 4168). 2♀, same data (K 4169). 4♂, same data except 21 Jan–7 Apr 1995 (K 4172). 6♀, same data (K 4171). 1♂, same data (K 4173). 4♂, same data except 7 Apr–16 May 1995 (K 4174). 5♀, same data (K 4175). 12♂, Central Highlands, Road 26, 0.2 km WNW of Donna Buang Rd junction, 37°43'S 145°39'30"E, 29 Nov 1994–20 Jan 1995, GAM (K 4167). 1♀, Kallista, Nov 1948, C. Oke (K 4247). 12♂, Otway Ranges, Aire Crossing Track, 0.5 km N of Aire River crossing, 38°42'S 143°29'E, 6 Sep to 15 Nov 1994, GAM (K 4177). 5♀, same data (K 4176). 1♀, same data (K 4106). 4♂, same data except 15 Nov 1994–31 Jan 1995 (K 4179). 3♀, same data (K 4178). 1♂, same data except 14 Jun–29 Aug 1995 (K 4181). 1♀, same data (K 4180). 1♂, Otway Ranges, Beauchamp Falls, 38°39'S 143°36'E, 30 Oct 1991, GAM (K 4182). 2♂, same data except 30 Oct–6 Nov 1991 (K 4183). 2♂, same data except 4–10 Dec 1991 (K 4184). 3♀, same data except 21–28 Jan 1992 (K 4185). 2♀, same data except 18–26 Feb 1992 (K 4186). 1♂, same data except 16–23 Apr 1992 (K 4187). 7♂, same data except 6 Sep–15 Nov 1994 (K 4188). 2♀, same data (K 4189). 1♂, same data (K 4190). 3♂, same data except 15 Nov 1994–31 Jan 1995 (K 4192). 4♀, same data (K 4191). 3♂, same data except 31 Jan–11 Apr 1995 (K 4194). 2♀, same data (K 4107). 7♀, same data (K 4193). 36♂, same data except 11 Apr–14 Jun 1995 (K 4195). 8♀, same data (K 4196). 2♂, same data (K 4197). 17♂, same data except 14 Jun–29 Aug 1995 (K 4199). 5♀, same data (K 4198). 1♀, same data (K 4200). 1♂, same data (K 4201). 1♀, Otway Ranges, Maits Rest, 10 km W of Apollo Bay, 38°45'S 143°34'E, 22 Oct 1991, GAM (K 4202). 3♀, same data except 30 Oct 1991 (K 4203). 8♂, same data (K 4204). 12♂, same data except 30 Oct–6 Nov 1991 (K 4205). 10♂, same data except 6–13 Nov 1991 (K 4206). 6♀, same data (K 4207). 9♂, same data except 4–10 Dec 1991 (K 4208). 1♀, same data (K 4209). 1♀, same data (K 4210). 1♀, same data except 21–28 Jan 1992 (K 4211). 1♀, same data except 18–24 Mar 1992 (K 4212). 7♂ Otway Ranges, Phillips Track, 0.5 km N of Triplet Falls, 38°40'S 143°29'E, 30 Oct 1991, GAM (K 4213). 1♂, same data except 30 Oct–6 Nov 1991 (K 4215). 1♀, same data (4214). 1♀, same data except 6–13 Nov 1991 (K 4216). 3♂, same data except 4–10 Dec 1991 (K 4217). 23♂, same data except 6 Sep–15 Nov 1994 (K 4218). 8♀, same data (K 4219). 1♀, same data (K 4102). 10♂, same data except 15 Nov 1994–31 Jan 1995 (K 4220). 3♀, same data (K 4221). 5♀, same data except 31 Jan–11 Apr 1995 (K 4222). 1♂, same data except 11 Apr–14 Jun 1995 (K 4223). 2♂, same data (K 4224). 10♂, same data except 14 Jun–29 Aug 1995 (K 4225). 3♀, same data (K 4226). 55♂ Otway Ranges, Young Creek Rd, 0.2 km NE of Ciancio Creek crossing, 38°42'S 143°29'E, 6 Sep–15 Nov 1994, GAM (K 4227). 20♀, same data (K 4228). 1♀, same data (K 4105). 32♂, same data except 15 Nov 1994–31 Jan 1995 (K 4229). 12♀, same data (K 4230). 14♀, same data except 31 Jan–11 Apr 1995 (K 4231). 1♀, same data except 11 Apr–14 Jun 1995 (K 4232). 7♀, same data (K 4233). 10♂, same data except 14 Jun–29 Aug 1995 (K 4234). 3♀, same data (K 4235). 20♂ Otway Ranges, Young Creek Rd, 0.4 km NW of Triplet Falls, 38°40'S 143°29'E, 6 Sep–15 Nov 1994, GAM (K 4236). 1♀, same data (K 4237). 28♂, same data except 15 Nov 1994–31 Jan 1995 (K 4238). 16♀, same data (K 4239). 1♀, same data (K 4103). 8♀, same data except 31 Jan–11Apr 1995 (K 4242). 7♂, same data except 11 Apr–14 Jun 1995 (K 4240). 6♀, same data (K 4241). 1♀, same data (K 4243). 28♂, same data except 14 Jun–29 Aug 1995 (K 4244). 6♀, same data (K 4245). 1♂, same data (K 4246). 1♂, Sherbrooke Forest, Aug 1974 (K 4284). 9♂, Strzelecki Ranges, Gunya-Toora Rd, 2 km SSW of Gunyah Gunyah, 38°32'30"S 146°19'E, 14 Sep–14 Nov 1995, GAM (K 4249). 1♀, same data (K 4250). 2♂, same data except 14 Nov 1995–10 Jan 1996 (K 4251). 2♀, same data (K 4252). 11♂, same data except 7 May–16 Jul 1996 (K 4253). 9♀, same data (K 4254). 1♂, same data (K 4255). 3♂, Strzelecki Ranges, Jeeralang West Rd, 0.1 km N of Binns Hill Junction, 38°26'30"S 146°29'E, 14 Sep–14 Nov 1995, GAM (K 4256). 11♂, same data except 14 Nov 1995–10 Jan 1996 (K 4257). 2♀, same data (K 4258). 4♀, same data except 10 Jan–5 Mar 1996 (K 4259). 8♂, same data except 7 May–16 Jul 1996 (K 4260). 1♀, same data (K 4261). 50♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, Bulga Picnic Area, 38°25'30"S 146°34'20"E, 14 Sep–14 Nov 1995, GAM (K 4262). 10♀, same data (K 4263). 19♂, same data except 14 Nov 1995–10 Jan 1996 (K 4264). 2♀, same dta (K 4265). 1♂, same data except 5 Mar–7 May 1996 (K 4266). 3♀, same data (K 4267). 8♂, same data except 7 May–16 Jul 1996 (K 4268). 3♀, same data (K 4269). 4♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, 0.5 km NNE of Tarra Valley Picnic Area, 38°26'40"S 146°32'30"E, 14 Sep–14 Nov 1995, GAM (K 4270). 3♀, same data (K 4271). 9♂, same data except 14 Nov 1995–10 Jan 1996 (K 4273). 2♀, same data (K 4108). 3♀, same data (K 4274). 8♂, same data except 5 Mar–7 May 1996 (K 4275). 1♂, same data (K 4276). 6♀, same data (K 4277). 1♀, same data (K 4278). 11♂, same data except 7 May–16 Jul 1996 (K 4279). 1♀, same data (K 4280). 1♂, same data except 14 Nov 1995 (K 4272). 86♂, Strzelecki Ranges, Tarra-Bulga Nat. Pk, 0.2 km W of Tarra Valley Picnic Area, 38°27'S 146°32'E, 14 Sep–14 Nov 1995, GAM (K 4281). 7♀, same data (K 4282). 37♂, same data except 14 Nov 1995–10 Jan 1996 (K 4283). 4♀, same data (K 4284). 2♂, same data except 10 Jan–5 Mar 1996 (K 4285). 6♀, same data (K 4286). 1♀, same data (K 4287). 5♀, same data except 5 Mar–7 May 1996 (K 4288). 10♂, same data except 7 May–16 Jul 1996 (K 4289). 9♀, same data (K 4290). 1♀, same data (K 4109). 1♂, Turton's Creek, near Foster, [38.32S 146.14E], 10 Jun 1972, Bell (K 4290). 21♂, 1f, DCE Upper Yarra site 2, 10.4 km NW of Toorongo, 37°44'S 146°01'E, 14–24 Nov 1988, L. Lumsden (K 4292). 1♀, same data (K 4293). 1♀, same data (K 4294). 1♀, same data (K 4295). 1♀, same data (K 4296). 1♀, same data (K 4297). 20♂, DCE Upper Yarra site 4, 1.5 km E of Fifteen Mile, 37°40'S

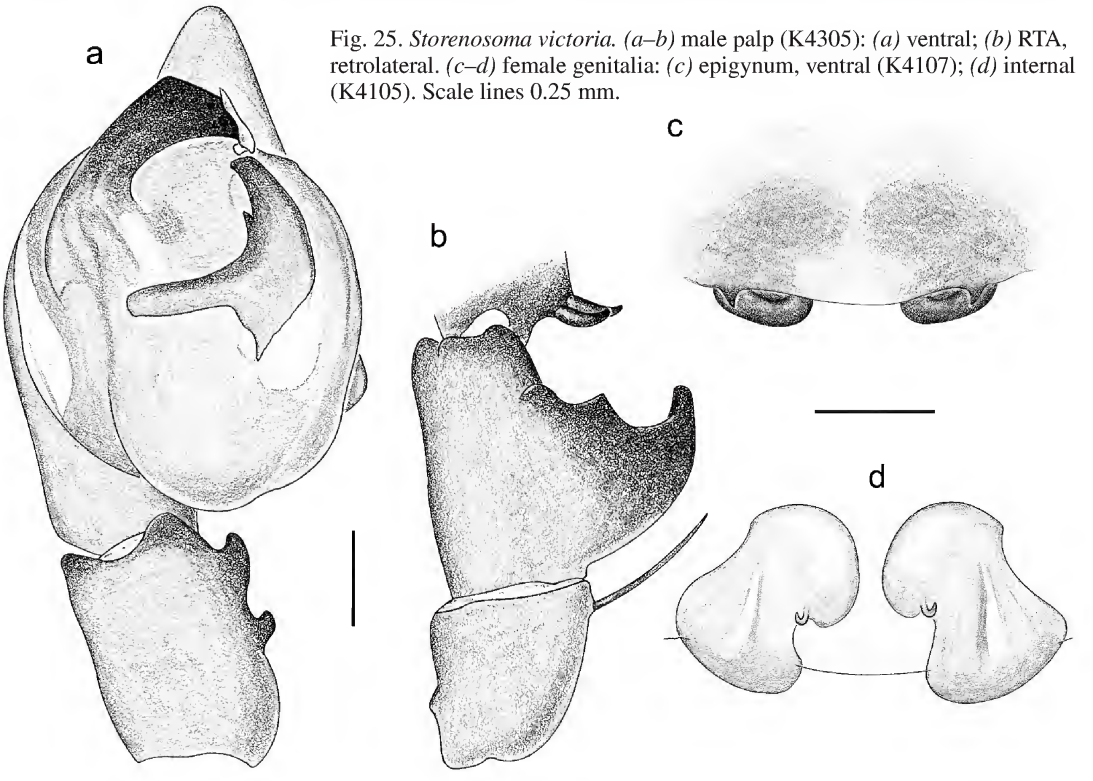

Fig. 25. *Storenosoma victoria. (a–b)* male palp (K4305): *(a)* ventral; *(b)* RTA, retrolateral. *(c–d)* female genitalia: *(c)* epigynum, ventral (K4107); *(d)* internal (K4105). Scale lines 0.25 mm.

146°04'E, 14–24 Nov 1988, L. Lumsden (K 4298). 4♂, DCE Upper Yarra site 5, 2.5 km ESE of Fifteen Mile, 37°40'S 146°05'E, 14–24 Nov 1988, L. Lumsden (K 4299). 13♂, DCE Upper Yarra site 6, 11 km NE of McMahons Creek, 37°39'S 145°56'E, 14–24 Nov 1988, L. Lumsden (K 4300). 13♂, DCE Upper Yarra site 7, 11.3 km ENE of McMahons Creek, 37°40'S 145°57'E, 14–24 Nov 1988, L. Lumsden (K 4301). 4♀, same data (K 4032). 2♀, same data (K 4303). 3♂, DCE Upper Yarra site 8, 11.4 km ENE of McMahons Creek, 37°41'S 145°57'E, 14–24 Nov 1988, L. Lumsden (K 4305). 1♂, DCE Upper Yarra site 9, 9.6 E of McMahons Creek, 37°41'S 145°56'E, 14–24 Nov 1988, L. Lumsden (K 4304) (all NMV). 3♀, Maits Rest, Otway Ranges, 38°45'S 143°35'E, 4 Nov 1997, GBM & SRM, (S 46470) (QM). 1♀, The Beeches, 37°28'S 145°49'E, 25 Mar 1991, M.S. Harvey & M.E. Blosfelds (95/1181-3). 1♂, Cumberland Falls, 37°34'S 145°53'E, 27 May 1991, M.S. Harvey & M.E. Blosfelds (95/1184) (both WAM).

Diagnosis. Male palp (Figs 25a–b) without obvious TA but with slight expansion at base of embolus. MA compact with elongate prolateral projection but no other pronounced projections. Embolus broad with median expansion, abruptly narrowing to pointed tip. Cymbium without basal swelling but with two to three stout basal prolateral macrosetae. Palpal patella with single stout dorsal hair, palpal tibia without spines. Female epigynum (Figs 25c–d) with small lateral teeth. Tarsal organ capsulate (Fig. 8d,h), situated distally of trichobothria.

Description. *Male*. Measurements: BL 6.80, CL 3.50, CW 2.75, PLE 3.40, PME 2.50 (AMS KS44941). *Female*. Measurements: BL 8.05, CL 3.30, CW 2.85, PLE 3.40, PME 2.50 (AMS KS45290). For morphological description see species diagnosis and generic description.

Etymology. The specific name refers to the known range of this species, the state of Victoria. It is a noun in apposition.

Distribution. Known only from Victoria (Fig. 27b)

Remarks. The presence of stout prolateral basal macrosetae on the male cymbium suggests that this is the sister species to *S. terraneum*, the only other species in the genus with this feature.

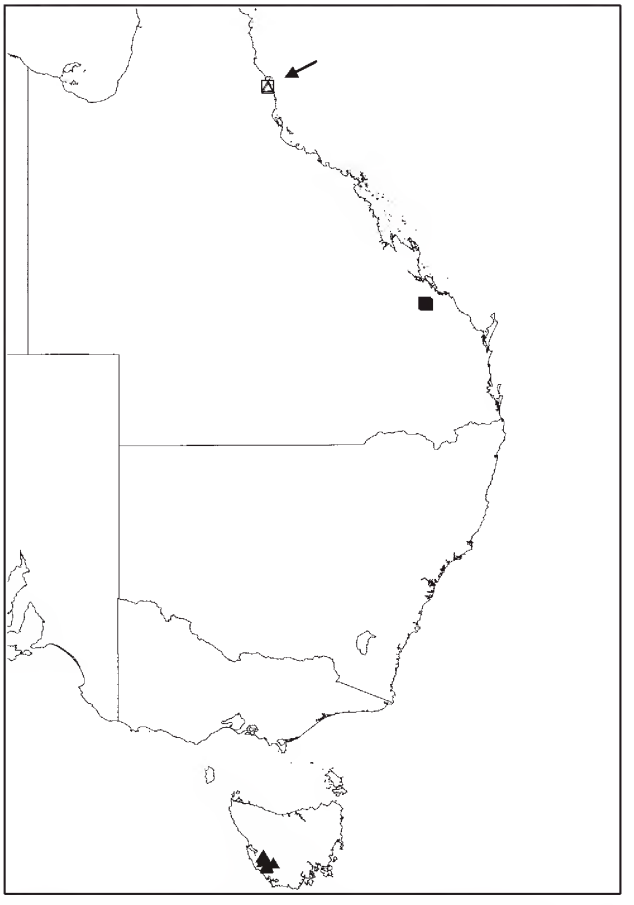

Fig. 26. Distribution of *Oztira* spp.: ▲ *O. affinis*, ■ *O. kroombit*, □ *O. aquilonaria*, and △ (indicated by arrow) *O. summa*.

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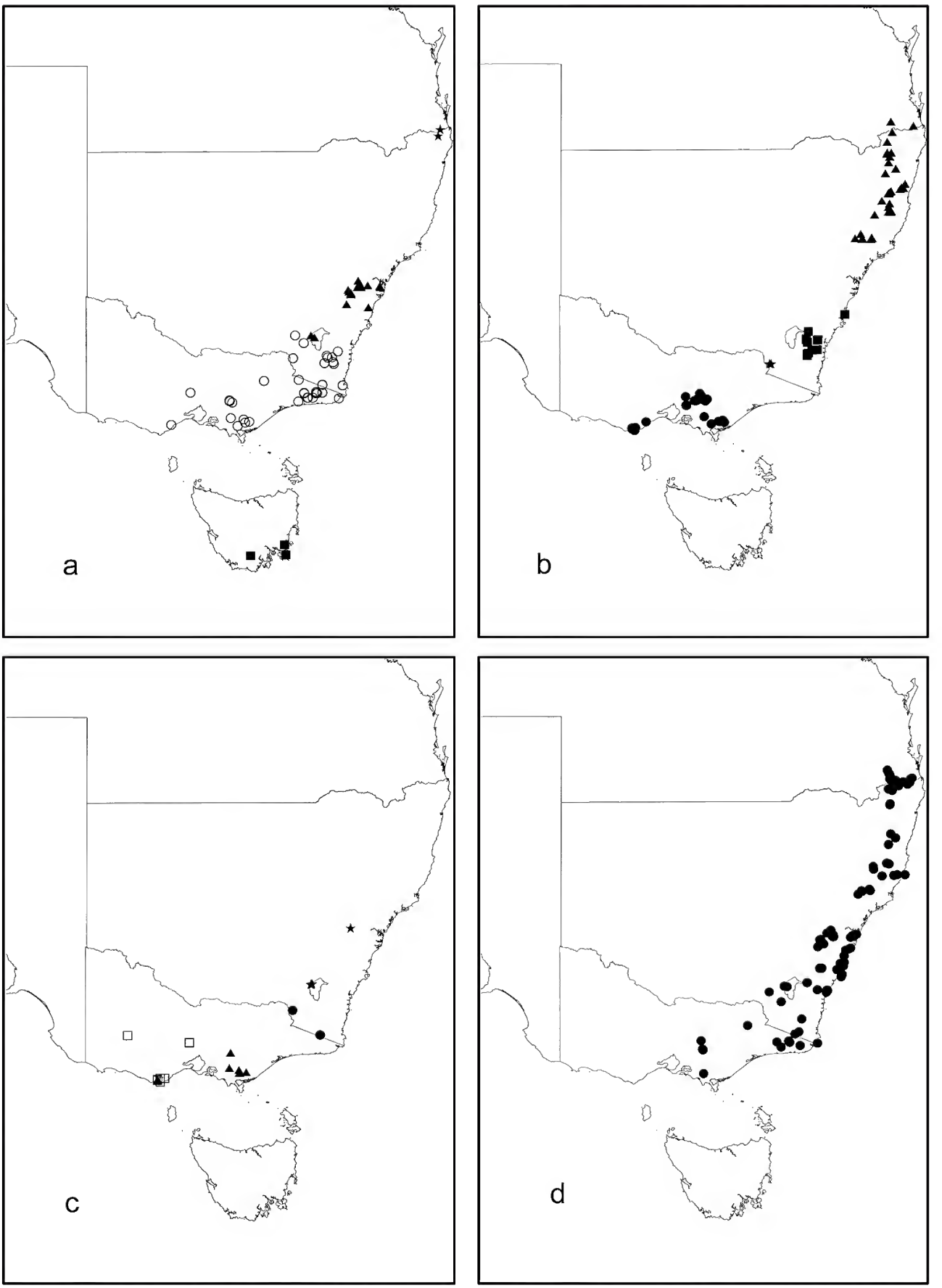

Fig. 27. Distribution of *Storenosoma* spp.: *(a)* ■ *S. tasmaniensis,* ○ *S. hoggi,* ▲ *S. forsteri,* ★ *S. supernum. (b)* ● *S. victoria,* ★ *S. smithae,* ■ *S. grayi,* ▲ *S. altum. (c)* □ *S. grossum,* ▲ *S. bifidum,* ● *S. bondi,* ★ *S. picadilly. (d)* ● *S. terraneum.*

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Trapdoor Spiders of the Genus *Misgolas* (Mygalomorphae: Idiopidae) in the Illawarra and South Coast Regions of New South Wales, Australia

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ABSTRACT. This paper reports on species of the idiopid trapdoor spider genus *Misgolas* Karsch, 1878 found in the Illawarra and South Coast Regions of New South Wales, Australia. They comprise eight new species: *M. horsemanae* n.sp., *M. gwennethae* n.sp., *M. phippsi* n.sp., *M. kampenae* n.sp., *M. paulaskewi* n.sp., *M. rowelli* n.sp., *M. tannerae* n.sp. and *M. shawi* n.sp. Four species dealt with in Wishart (1992) and one in Wishart (2006) are also included in the region covered by this work: *M. rapax* (synonymous with *M. hubbardi), M. dereki, M. kirstiae, M. robertsi* (Main & Mascord, 1974) and *M. gracilis* respectively. *M. elegans* (Rainbow & Pulleine, 1918) is retained here but is regarded as a nomen dubium. Evidence is provided supporting the species status of *M. montanus* (Rainbow & Pulleine, 1918). A key for males of the species within the region is presented, as well as distribution map and comments on taxonomy and natural history.

WISHART, GRAHAM, 2011. Trapdoor spiders of the genus *Misgolas* (Mygalomorphae: Idiopidae) in the Illawarra and South Coast regions of New South Wales, Australia. *Records of the Australian Museum* 63(1): 33–51.

This paper is third in a geographical series and continues the regional documentation of species of the trapdoor spider genus *Misgolas* Karsch, 1878 found in New South Wales (Wishart, 2006 & Wishart & Rowell, 2008). A further eight new species are added to the NSW list of 42. For the completion of the series two NSW regions still remain, the Far North Coast of NSW and the Great Dividing Range together with its Western Slopes. This present work identifies species collected from the region immediately south of the Sydney Region, from Port Hacking south along the coastal strip to the Victorian Border.

One species, *Misgolas gracilis* (Rainbow & Pulleine, 1918), is dealt with by Wishart (2006, p. 7, fig. 3) and Wishart & Rowell (2008). Its distribution extends from the Sydney and Central Coast Regions into the region covered by this work (Fig. 14A). For this spider the southern most extent of its distribution appears to be the Minnamurra Falls National Park.

Material and methods

Methodology follows that of Wishart (2006). All specimens are deposited in the Australian Museum, Sydney. Measuring points are taken from Coyle (1971).

Whilst at rest the bulb of the male palpal organ is folded into the ventral excavation of the palpal tibia. Usually the brown sclerous convex side is uppermost against the tibia cavity and is considered here to be the dorsal surface. The weakly chitinous flange is retrolaterally situated on the basal part of the embolus. The configuration of the embolus of the male bulb (e.g., straight or bent) is described from dorsal aspect. Measurements and counts refer to the characters on the right side of the specimen and where provided data for the left side is given in brackets. Notation of spines is taken from Forster & Wilton (1968).

Terminology

Terminology follows that of Wishart (2006). *ALE*, anterior lateral eyes; *AMS*, Australian Museum, Sydney (specimens listed under accession numbers prefixed *KS* are deposited in the AMS); *AME*, anterior median eyes; *d*, dorsal; *DTA*, distal tibial apophysis, a small, often hooked, apical apophysis positioned retrodorsally on tibia of male palp (usually present); *GW*, Graham Wishart; *pd*, prodorsal; *pl*, prolateral; *PLE*, posterior lateral eyes; *PME*, posterior median eyes; *PMS*, posterior median spinnerets; *pv*, proventral; *rd*, retrodorsal; *rl*, retrolateral; *RTA*, retroventral tibial apophysis, a prominent apophysis projecting generally forward from c. midway on tibia of male palp; *rv*, retroventral; *TEM*, tibial excavation mound, a usually pallid mound within tibial excavation, of variable prominence, prolaterally adjacent to or contiguous with RTA; *TET*, tibial excavation texture, a textured area of a series of raised transverse lines within palpal tibial excavation and which encroaches upon TEM; *v*, ventral; *width/length ratio*, ratio of maximum width to length of ocular area; only rarely, and then only marginally, is this greater than 2 (Main, 1985a).

Key to males of species in the genus *Misgolas* from the New South Wales Illawarra and South Coast Regions

1 Palpal distal tibial apophysis hooked (Fig. 3A) 2
—— Distal tibial apophysis straight, horizontal (Fig. 2A) or absent, embolic apophysis absent (Figs 2B,C) 3

2 Retrolateral embolic flange appearing inflated sail-like; edge markedly curved with three, rarely four, prominent folds (Fig. 1B) ..... *M. dereki*
—— Embolic flange with more than four folds 4

3 Embolus slender & sinuous, apophysis absent (Figs 2B,C) ..... *M. kirstiae*
—— Embolus robust & straight, (Figs 3B,C) 12

4 Embolic apophysis subdistal, retrolaterally positioned (Figs 4B,C) 5
—— Embolic apophysis dorsal, not retrolaterally positioned 6

5 Venter entirely dark brown, black (Fig. 3F) ..... *M. gwennethae*
—— Venter pallid with dark brown speckle (Fig. 4G) ..... *M. rapax*

6 Venter pallid with distinctive dark brown median band (Fig. 5E) ..... *M. robertsi*
—— Venter lacking dark brown median band 7

7 Embolus from dorsal aspect straight or almost so (Fig. 6B) ..... *M. phippsi*
—— Embolus from dorsal aspect with prolateral bend or tip sinuous 8

8 Distal part of embolus short, about half length of embolic flange edge (Fig. 7B) ..... *M. kampenae*
—— Distal part of embolus and embolic flange edge about equal length (Fig. 8B) 9

9 9 Anterior limbs with prominent dark brown lateral smudges (Fig. 8E–H) ..... *M. paulaskewi*
—— Brown smudges weak or absent on anterior limbs (Figs 11E–F) 10

10 Retrodorsal surface of metatarsus IV with spines (Fig. 9E) ..... *M. rowelli*
—— Retrodorsal surface of metatarsus IV lacking spines (Fig. 10F) 11

11 Lateral surfaces of abdomen with distinct, prominent brown spots (Figs 10D,G) ..... *M. tannerae*
—— Prominent brown spots absent ..... *M. shawi*

12 Embolic flange edge entire, lacking folds ..... *M. horsemanae*
—— Embolic flange with one prominent fold (Wishart, 2006, figs 3B–C) ..... *M. gracilis*

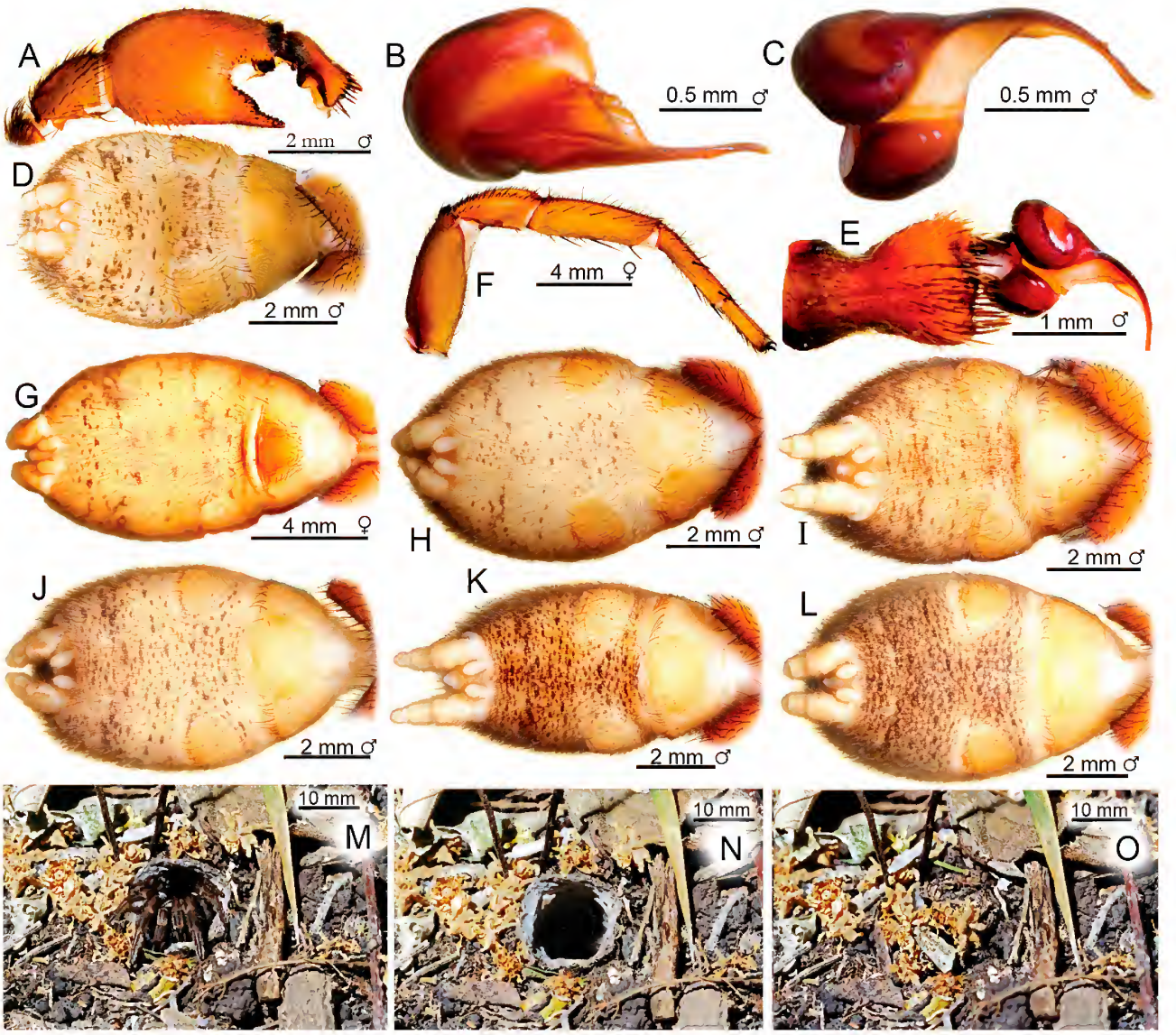

Fig. 1. *Misgolas dereki.* *(A–E)* ♂, holotype AMS KS22326: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* venter. *(E)* right cymbium dorsal. *(F)* ♀, allotype AMS KS22327, right leg IV retrolateral. *(G)* ♀, paratype AMS KS22345, venter. *(H–L)* ♂ venter: *(H)* AMS KS92891, *(I)* AMS KS92890, *(J)* AMS KS38819, *(K)* AMS KS38618, *(L)* AMS KS92892. *(M–O)* burrow entrance at type locality 16 Oct 1988: *(M)* spider in foraging position, *(N)* burrow lip/collar open, *(O)* burrow lip/collar closed.

Misgolas Karsch, 1878

Type species. *Misgolas rapax* Karsch, 1878: 821. New South Wales.

Hermeas Karsch, 1878: 823. Type species by monotypy. *Hermeas crispus* Karsch, 1878. Synonymized with *Misgolas* by Main, 1985. See Main (1985) for generic diagnosis.

Misgolas dereki Wishart, 1992

Figs 1A–O, 14B

Misgolas dereki Wishart, 1992: 266–269.

Material examined. NEW SOUTH WALES: holotype ♂, AMS KS22326, "Scalloway", Willow Vale, nr Gerringong, NSW (34°44'11"S 150°47'23"E), 17 Oct. 1985, GW. Allotype ♀, AMS KS22327, 13 Jan. 1986, other details as for AMS KS22326.

The following material, also from New South Wales, also examined: ♂♂ AMS KS3644, Mt Keira Scout Camp, Wollongong (34°24'S 150°51'E), 14 Mar. 1979, M Gray & C Horseman. AMS KS30875, Dapto, NSW (34°30'S 150°47'E), 24 Mar. 1992. AMS KS38618, "Lightwood Park" Williams Rd, Jamberoo, NSW (34°36'46"S 150°47'27"E), 4 Apr. 1988, S Meredith. AMS KS38619, 30 Apr. 1988, other details as for AMS KS38618. AMS KS48700, Wiarborough nr Taralga, NSW (34°12'S 149°54'E), 15 Apr. 1968, G. Cosgrove. AMS KS92890, 30 Apr. 1988, other details as for AMS KS38618. AMS KS92891, 30 Apr. 1988, other details as for AMS KS38618. AMS KS92892, 4 Apr. 1988, other details as for AMS KS38618.

Diagnosis. Specimens located south of approximately latitude 34°38'S, includes type locality: in male & female: medium sized brown spiders, retrodorsal surface of metatarsi IV with spines (Fig. 1F). Venter pallid with sparse, scattered dark brown speckles distant from spinneret region (Fig. 1D,G). In female: carapace length c. 7.7–11.5. In male: carapace length c. 6.0–8.1. Embolus of bulb with small, dorsal, thorn-like apophysis placed about mid-way; retrolateral flange with three prominent folds, edge markedly curved (Fig. 1B,C). Conformation of palp and spination of cymbium as figured (Fig. 1A,E). Specimens found north of latitude 34°38'S: venter pallid with range of densities of dark brown speckles varying from pallid to entirely dark brown often adjacent to spinneret region (Fig. 1H–L).

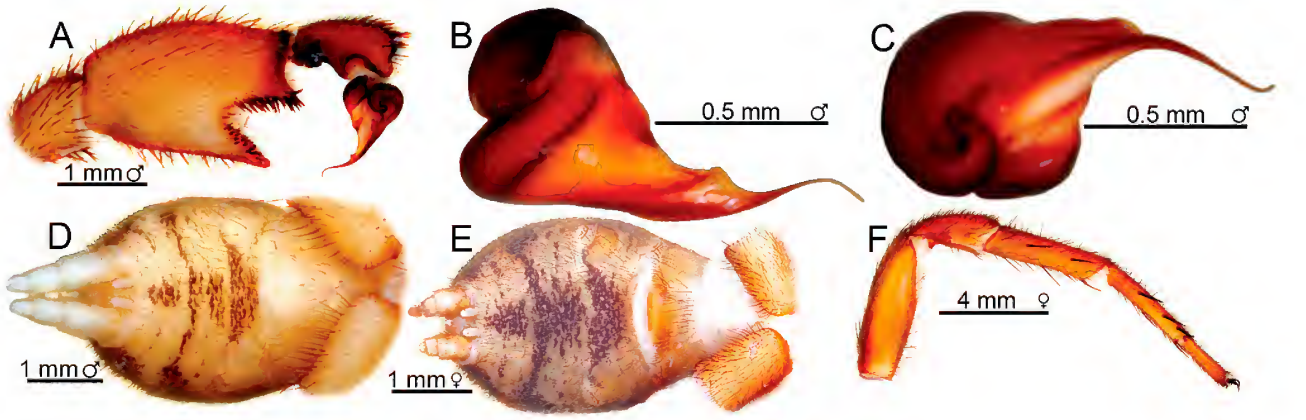

Fig. 2. *Misgolas kirstiae. (A–D)* ♂, holotype AMS KS22355: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* venter. *(E,F)* ♀, allotype AMS KS22356: *(E)* venter. *(F)* right leg IV retrolateral.

Remarks. Northwards from about a line represented by latitude 34°38'S some male specimens, though determined to be *M. dereki*, exhibit variable venter patterns and rarely, four, rather than three, prominent folds on the retrolateral embolic flange of the male bulb. A consistent unifying character is the retrolateral embolic flange appearing inflated sail-like; edge markedly curved and with prominent folds.

The wandering times of mature male *M. dereki* spiders from the type locality Wishart (1993) found almost all were collected during April to June of each year. This correlates approximately to the February-June period for the, albeit undisciplined, collection of 68 specimens from areas not included in the type locality, in particular the region north of latitude 34°38'S.

Typifying the variations of the venter pattern (Fig. 1H–L) are five male spiders all collected from the same in-ground home swimming pool during April, 1988. Consistent conformation of the palps and bulbs in these specimens supports these spiders being conspecific with *M. dereki*, yet the venter patterns are variable. It appears that there is a southern group within the species *M. dereki* whch exhibit consistent venter patterns and a northern group with inconsistent venter patterns. This is accepted as a natural genetic variation within this species which is fixed in most other *Misgolas* species.

Distribution and natural history. (Figs 1M–O, 14B) This spider has been collected northwards from the Shoalhaven River to Mount Keira nr Wollongong and westwards to Wiarborough (34°12'S 149°54'E) nr Taralga. Burrow entrance collar-like, level with ground (Fig. 1M–O). Subterranean structure about 25 cm deep, lined with fragile silk tube terminating at soft but strong, 3.5 cm long sock in which spider, sometimes with spiderlings, is often found (Wishart, 1992). Male spider wandering times most often during April-June each year (Wishart, 1993).

Misgolas kirstiae Wishart, 1992

Figs 2A–F, 14C

Misgolas kirstiae Wishart, 1992: 269–271.

Type material examined. NEW SOUTH WALES: holotype ♂, AMS KS22355, "Scalloway", Willow Vale, nr Gerringong, NSW (34°44'11"S 150°47'23"E), 6 Nov. 1985, GW. Allotype ♀, AMS KS22356, 5 Oct.1988, locality as for KS22355, maintained alive until 23 Jan. 1989, then preserved with 55 spiderlings.

Diagnosis. In male & female: small sized brown spiders; reflective hairs and many small black setae on carapace, retrodorsal surface of metatarsi IV with spines (Fig. 2F). Venter pallid with dark brown pattern most concentrated along median band (Fig. 2D,E). In female: carapace length c. 5.5–7.5. In male: carapace length c. 5.1–6.4. Embolus of bulb slender, sinuous, apophysis absent; retrolateral flange with one prominent fold (Fig. 2B,C). Conformation of palp as figured (Fig. 2A), distal tibial apophysis absent.

Distribution and natural history. Known only from type locality (Fig. 14C); burrow in the wild not known. Spiders found in excavated soil sometimes encased in soft fragile silken sock about 3 cm long, impregnated with soil; in captivity burrow entrance is sealed by halfmoon-shaped flap (Wishart, 1992). Mature males wander from September to November each year (Wishart, 1993).

Misgolas gwennethae n.sp.

Figs 3A–J, 14C

Misgolas hubbardi.–Wishart, 1992, 264–266, figs 1–6, misidentification. Removed from synonymy with *M. hubbardi* in Wishart & Rowell, 2008.

Type material. HOLOTYPE ♂, AMS KS38678, Berry, NSW, Primary School grounds (34°46'41"S 150°41'21"E), 15 Nov.1989, Janice Tanner. ALLOTYPE ♀, AMS KS44312, excavated from Berry Primary School grounds (34°46'41"S 150°41'21"E), 18 Sep. 1986, GW. PARATYPES ♂♂, AMS KS50064, Berry, in home swimming pool (34°47'S 150°42'E), 10 Sep. 1997, Don Webster. AMS KS38689, 6 June, 1988, other details as for holotype. AMS KS92885, 13 Sep. 2008, other details as for paratype AMS KS50064. Paratypes ♀♀, AMS KS44311, Berry, NSW, Primary School grounds (34°46'41"S 150°41'21"E), 18 Sep. 1986, GW. AMS KS92886, 13 Sep. 2008; other details as for paratype AMS KS44311. AMS KS22394, Berry, NSW, found in shoe (34°47'S 150°41'E), 28 Oct. 1992, Wendy Bramley, nee Hanbridge.

Other material examined. NEW SOUTH WALES: ♂♂, AMS KS38682, Foxground (34°42'44"S 150°44'27"E), 26 Aug.1982, J. Voorwinden. AMS KS23631, Kangaroo Valley (34°44'10"S 150°32'03"E), 15 Feb.1991, K. Goyer. AMS KS38680, Bomaderry railway station (34°51'15"S 150°36'35"E), 17 Sep.1990, C. Davis. AMS KS38679, North Nowra (34°52'23"S 150°35'30"E), 4 Oct.1987, Janice Tanner. AMS KS42343, Nowra (34°52'23"S 150°36'12"E), 15 Nov.1994. AMS KS38688, South Nowra, Quinns Lane (34°54'33"S 150°36'23"E), A. Cooper. AMS KS4279, St. Georges Basin (35°05'28"S 150°35'54"E), 15 Jan.1984, W. Bell. AMS KS22392, Wandandian (35°03'22"S 150°30'34"E), 20 Jul.1985. AMS KS1768, Bendalong (35°14'48"S 150°31'46"E), 2 Oct.1978. AMS KS38598, Milton (35°18'56"S 150°26'05"E), 15 Feb.1972, Carter. AMS KS38683, Bannister Head (35°19'05"S 150°28'20"E), 29 Feb.1988, T. Whittle. AMS KS16420, Batemans Bay (35°42'28"S 150°10'34"E), 15 Feb.1986, Lyn Abra.

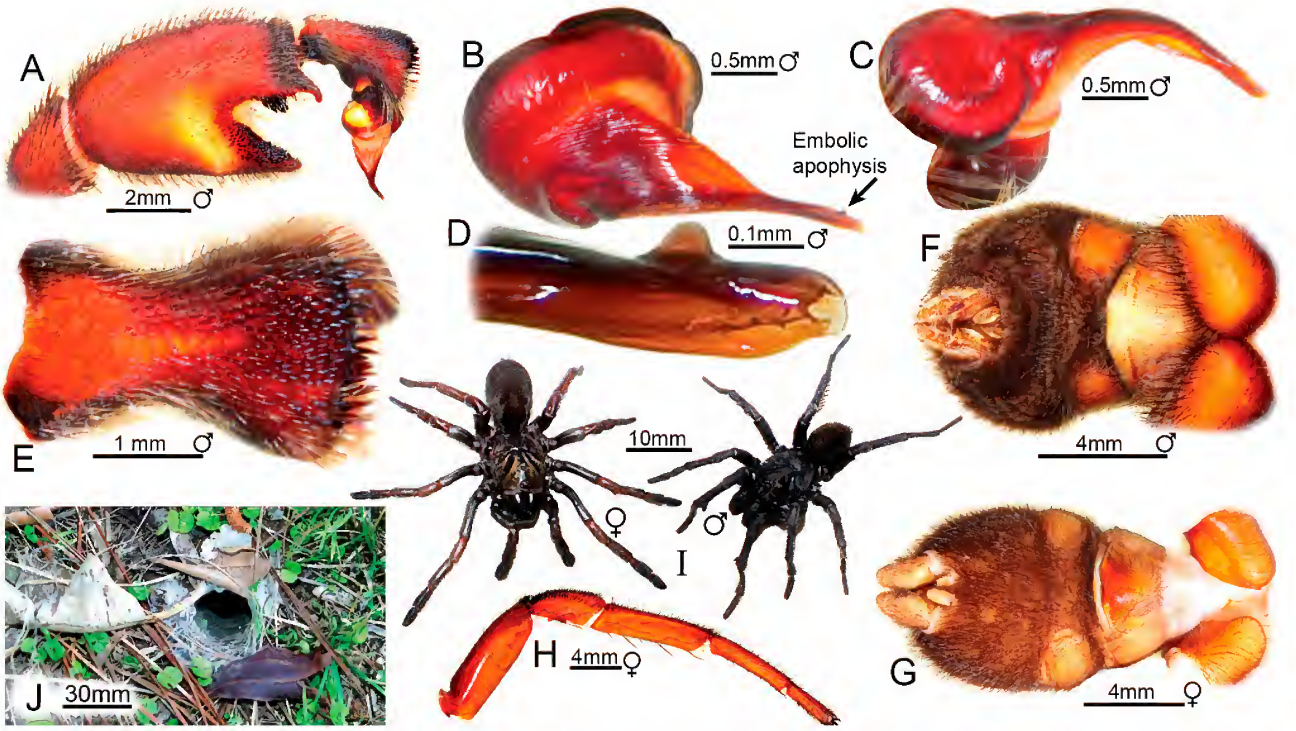

Fig. 3. *Misgolas gwennethae* n.sp. *(A–F)* ♂, holotype AMS KS38678. *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* embolus tip of right bulb dorsal. *(E)* right cymbium dorsal. *(F)* venter. *(G–H)* ♀, allotype AMS KS44312. *(G)* venter. *(H)* right leg IV retrolateral. *(I)* ♀ and ♂ spiders relative sizes, photographed live. *(J)* burrow entrance.

Diagnosis. Large (Fig. 3I), dark brown-black spiders (female lighter brown than male); carapace length male, c. 9.3–11.7, female to 12.3 maximum, retrodorsal surface of metatarsi IV lack spines (Fig. 3H); venter entirely dark brown-black (Fig. 3F,G); limb segments unicolourous. In male palpal bulb (Fig. 3B,C) with narrow retrolateral embolic flange with c. 8 folds, margin straight; embolic apophysis subdistal, retrolateral, apex flat as figured (Fig. 3D); conformation of palp as figured (Fig. 3A,E).

Description

Male holotype (Fig. 3A–F). *Size*. Carapace length 11.66, width 9.41. Abdomen length 8.92, width 6.27. — *Colour*. In alcohol chelicerae, carapace, abdomen dorsum and limbs dark brown; live spider appearing black. Venter entirely black. Dark brown lateral smudges not evident on limbs. Abdomen dorsum bearing few indistinct transverse chevrons. When dry carapace bedecked with golden hirsute sheen. — *Carapace*. Fine golden setae abundant on edge, caput and proximal leg segments. Edge fringed with black bristles which encroach onto posterior half of post foveal surface. Line of median bristles absent from caput arch; 8 posteriorly inclined and 6 anteriorly inclined bristles on clypeus. Fovea width 2.18, straight, recurved edges; posterior wall centrally divided by 2 pitted intrusions. — *Eyes*. Raised on a mound. Area immediately adjacent to eyes black. Anterior width 1.79, posterior width 1.66, length 1.01, width/length ratio 1.77. Line joining posterior edges of ALE transects anterior fifth of AME. Posterior row procurved in front, recurved behind. — *Chelicerae*. Rastellum front row of 7(7) spines, 3(3) behind on inner edge. Intercheliceral tumescence pallid, with cover of prostrate, anteriorly inclined setae. Fang groove with 8(8) promarginal teeth and 10(9) smaller retromarginal/intermediate row teeth. — *Labium*. Bulbous, length 1.31, width 1.72. Labio-sternal suture continuously broad. — *Maxillae* c. 49(60) small, pointed antero-ental cuspules, few terminated by a hair. — *Sternum*. Bulbous, length 6.14, width 4.54. Sigilla all small; first and second pairs submarginal, posterior pair each c. 3 times own diameter from margin. — *Legs*. Tibia I with distal bifid apophysis. Distal process with 2(2) short compact spines; proximal process row of 4(4) longer, curved pointed spines.

	Palp	I	II	III	IV
Femur	6.57	10.48	9.51	4.85	10.39
Patella	3.07	5.29	4.80	2.57	4.80
Tibia	5.83	7.35	6.66	2.95	8.72
Metatarsus	—	7.74	6.95	3.99	8.53
Tarsus	2.88	4.80	4.50	2.64	4.80
Total	18.35	35.66	32.42	17.00	37.24

Palp. (Fig. 3A,E) Many short anteriorly inclined, skewer-like spines on distal half of cymbium d surface. RTA thick set, not inclined from horizontal, not swollen, d and rd surfaces covered with squat pointed spines. Tibial excavation rv edge with suspended brush of c. 27 long spines. Prominent DTA hooked lacking spines. Large TEM, with postero-ental TET, contiguous with RTA. — *Bulb*. (Fig. 3B,C) Length 3.16. Embolic rl flange with 8 major folds, 2 minor folds; margin straight. Embolus straight with subdistal, rl apophysis as figured (Fig. 3D). Length from embolic apophysis to embolus tip (a) 0.17; length from embolic flange terminus to embolus tip (f) 0.69; a/f ratio 0.25. — *Scopula*. Complete on all tarsi and metatarsi I and II; incomplete on metatarsi III and IV. — *Trichobothria*. Palp: tarsi 12, tibia pd 7, rd 7. Leg I: tarsi 16, metatarsi 15, tibia pd 8, rd 9. Leg II: tarsi 14, metatarsi 18,

tibia pd 9, rd 7. Leg III: tarsi 18, metatarsi 16, tibia pd 10, rd 10. Leg IV: tarsi 16, metatarsi 15, tibia pd 9, rd 9. — *Leg spination.* Spines absent on all tarsi. Leg I: tibia rv 0111. Leg II: metatarsi v 0100; tibia v 0113. Leg III: metatarsi v 021, pd 001110, rd 001110; tibia v 0112, pl 0110, rl 00110; patella pd 3. Leg IV: metatarsi v 33 scattered on proximal half; tibia v 0112, rl 010. — *Abdomen.* Dorsum with cover of long, dark brown, erect bristles and underlying dense cover of fine pallid hairs. Venter with cover of shorter dark brown bristles and underlying prostrate hairs.

Female allotype (Fig. 3H,G). *Size.* Carapace length 10.88, width 8.13. Abdomen length 11.56, width 7.64. — *Colour.* In alcohol chelicerae and carapace brown; limbs where pubescent dark brown, glabrous areas lighter; abdomen dorsum dark brown, bearing few indistinct transverse chevrons. Venter entirely dark brown-black (Fig. 3G). When dry carapace displays golden hirsute sheen; long, wispy, golden setae extend onto proximal segments of legs I and II. — *Carapace.* Edge sparsely fringed with pallid brown hairs. Line of weak setae (some removed) on caput arch; c. 12 bristles on clypeus and weakly chitinous pleuron membrane below clypeus. Fovea width 1.89, straight, edges slightly recurved; posterior wall not pitted. — *Eyes.* Placed on a low mound. Area immediately adjacent to eyes dark brown. Anterior width 1.59, posterior width 1.48, length 0.92, width/length ratio 1.73. Line joining posterior edges of ALE is anterior tangent of AME. Posterior row procurved in front, recurved behind. — *Chelicerae.* Rastellum row of 10(9) spines; 10(9) in disordered second row; few retreating along pl edge. Fang groove with 10(8) promarginal teeth and 13(17) small retromarginal/intermediate row teeth. — *Labium.* Bulbous, length 1.26, width 1.70. Labio-sternal suture continuous, narrow. — *Maxillae* c. 40(39) blunt cigar-shaped antero-ental cuspules. — *Sternum.* Length 5.97, width 4.31. Sigilla all small, round; first and second pairs submarginal, posterior pair each c. 3 times own diameter from margin. — *Legs*:

	Palp	I	II	III	IV
Femur	6.39	8.23	7.25	5.49	7.94
Patella	1.96	4.61	4.21	3.53	4.51
Tibia	2.89	5.19	4.31	2.84	6.37
Metatarsus	—	4.31	3.82	3.43	5.49
Tarsus	2.58	2.74	2.65	2.40	2.74
Total	13.82	25.08	22.24	17.69	27.05

Scopula. Dense, dark grey in colour. Complete v cover on palpal tarsi, tarsi I and II and metatarsi I. Weak, incomplete on metatarsi II. Absent on legs III and IV. — *Trichobothria.* Palp: tarsi 13, tibia pd8, rd8. Leg I: tarsi 15, metatarsi 16, tibia pd 9, rd 8. Leg II: tarsi 14, metatarsi 16, tibia pd 9, rd 8. Leg III: tarsi 13, metatarsi 15, tibia pd 9, rd 8. Leg IV: tarsi 11, metatarsi 15, tibia pd 9, rd 8. — *Leg spination.* Palp: tarsi pv 010000, rv 01000; tibia pv 7 scattered, rv 0111. Leg I: metatarsi v 0102; tibia rv 0111. Leg II: metatarsi v 0203; tibia v 0111. Leg III: tarsi v 14 scattered; metatarsi v 9 scattered, pd 001110, rd 000110; tibia pd 0010, rd 01010; patella pd 6. Leg IV: tarsi v 20 scattered; metatarsi v 6 plus many spinules scattered. — *Abdomen.* Dorsum with sparse cover of weak dark brown erect bristles and underlying dense cover of fine hairs. Venter with cover of shorter dark brown bristles and underlying prostrate hairs. — *Genitalia.* Sclerous lip of epigynum as figured (Fig. 3G).

Remarks. Wishart & Rowell (1997) referred to this spider as "Berry population" and attributed it, with some reservations, to *Misgolas hubbardi* Wishart, 1992. Wishart & Rowell (2008) reversed the earlier decision and what was referred to as "Berry population" is raised here to the new species *M. gwennethae. M. hubbardi* was placed in synonymy with *Misgolas rapax* Karsch.

Etymology. The species is named in honour of my wife, Gwenneth, and in recognition of a great part of her lifetime spent encouraging my spider interests.

Distribution and natural history (Fig. 14C). Distribution of the species is taken to be coastal east of the Great Dividing Range, from Foxground (34°42'44"S 150°44'27"E) to the north, southwards to Batemans Bay (35°42'28"S 150°10'34"E), a range of about 120 km.

Of 14 wandering male spiders captured within the Berry township all were collected during the June to December periods of several years. The sample size is small and collection undisciplined but, at least for the restricted Berry region, the conclusion is significant and does not greatly contradict Wishart & Rowell's result (1997) based on 38 spiders collected throughout the range.

The burrow (Fig. 3J) is similar to that of *M. rapax* (= *M. hubbardi*) described by Wishart (1992) with an exception being the entrance which is often only marginally oblique. The underground burrow appears to be identical and is as described for the "Berry population" by Wishart & Rowell (1997).

The male spider is large, essentially very black and has a propensity for prolonged aggressive behaviour in the manner of the Sydney Funnelweb spider, *Atrax robustus* (Hexathelidae: Atracinae). It is not known to be seriously harmful.

Misgolas rapax Karsch, 1878

Figs 4A–K, 14A

Misgolas rapax Karsch, 1878: 821–823. Type species of *Misgolas* Karsch, 1878; Simon, 1892: 116; Bonnet, 1957: 2931; Wishart, 2006: 1–18; Wishart & Rowell, 2008: 45–86.

Misgolas hubbardi Wishart, 1992: 263–278, figs 1–6, 28–29; placed in the synonymy of *M. rapax* by Wishart & Rowell, 2008: 45–86.

Misgolas rapax Karsch, 1878.–Wishart & Rowell, 2008: 45–86: the first three of the six species listed below are explicitly removed from synonymy with *M. rapax*, while the last three species are each considered to be nomen dubia because female characters are unreliable for the diagnosis of these species. All of these species are treated below or in Wishart (2006) and Wishart & Rowell (2008).

Megalosora villosa Rainbow, 1914, *Dyarcyops melancholicus* Rainbow & Pulleine, 1918, *Arbanitis montanus* Rainbow & Pulleine, 1918, *Arbanitis fuscipes* Rainbow, 1914, *Dyarcyops ionthus* Rainbow & Pulleine, 1918 and *Arbanitis chisholmi* Hickman, 1933.

Material examined. NEW SOUTH WALES: holotype ♀ from NSW, Museum fur Naturkunde an der Humbolte Universitat zu Berlin, Germany, dried, pinned, deteriorated specimen, possibly collected 1874–75, Edward Damel (Daemel) (Fig. 4K). Holotype ♂ of *Misgolas hubbardi* Wishart, AMS KS22301, "Scalloway", Willow Vale nr Gerringong, NSW (34°44'11"S 150°47'23"E), 17 Dec. 1985, GW. Allotype ♀ *Misgolas hubbardi* Wishart, AMS KS22302, 10 June 1985, other details as for AMS KS22301.

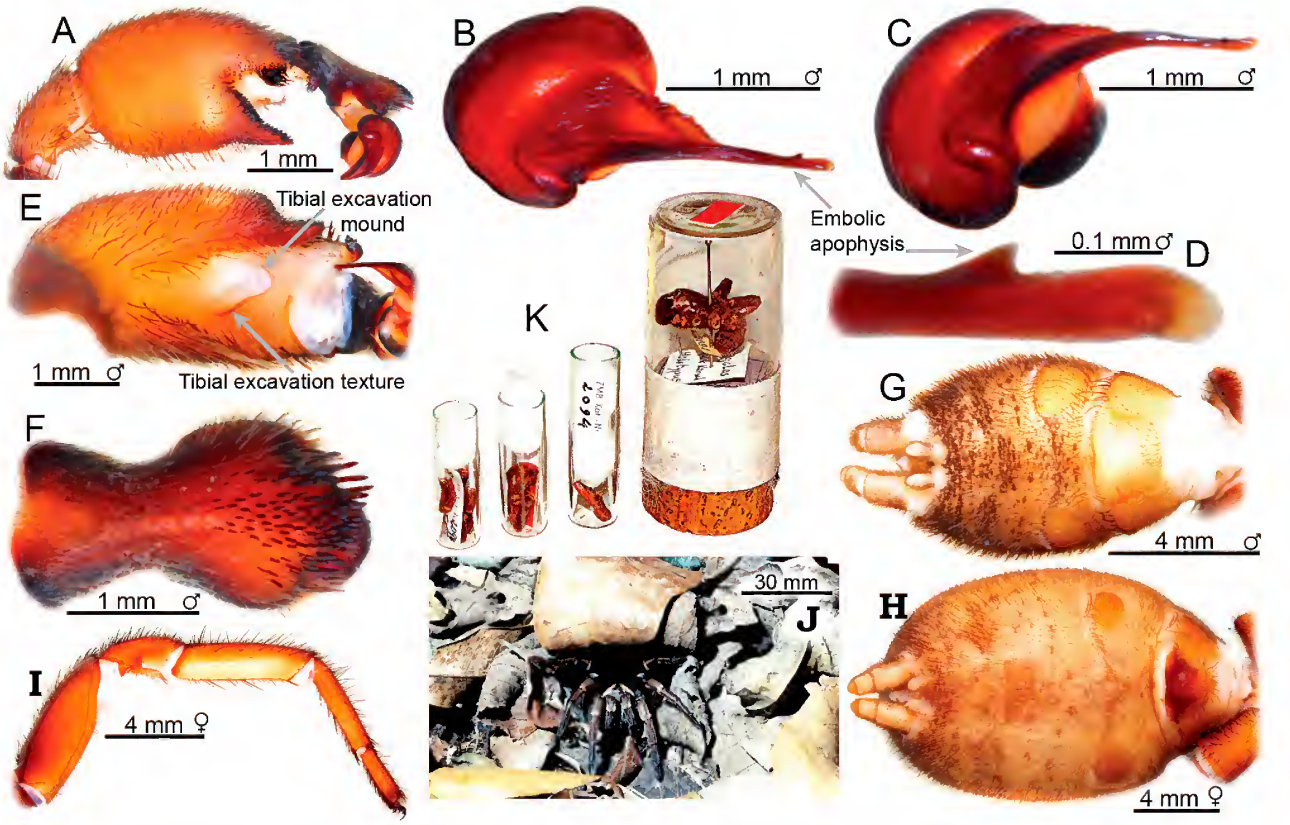

Fig. 4. *Misgolas rapax* Karsch: *Misgolas hubbardi* Wishart *(A–G)* ♂, holotype AMS KS22301. *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* embolus tip of right bulb dorsal *(E)* right palpal tibia excavation ventral. *(F)* right cymbium dorsal. *(G)* venter. *(H–I)* ♀, allotype AMS KS22302. *(H)* venter. *(I)* right leg IV retrolateral. *(J)* burrow entrance, spider in foraging position. *(K)* *Misgolas rapax*, type specimen of genus *Misgolas* Karsch, 1878.

Diagnosis. In male and female: large sized brown spiders; retrodorsal surface of metatarsi IV lack spines (Fig. 4I). Venter pattern as figured, dark brown speckle more dense immediately adjacent to spinnerets (Fig. 4G,H). In female: carapace length c. 10–13.5. In male: carapace length c. 8.2–10.5. Embolus of bulb apically twisted clockwise through 90° with subdistal thorn-like apophysis as figured (Fig. 4D) appearing to be retrolaterally positioned; retrolateral flange with about 5 folds, edge straight (Fig. 4B,C). Conformation of palp as figured (Fig. 4A,F).

Distribution and natural history. (Figs 4J, 14A) Numerous specimens of this large spider have been collected in and nearby the small township of Gerringong (New South Wales, Australia). Collection sites most remote from Gerringong are the town of Kiama 10 km to the North and localities of Toolijooa and Harley Hill 10 km to the southwest. Mature males wander almost throughout the year (Wishart, 1993). Burrow entrance (Fig. 4J) is rigid, funnel-like, the lip at an oblique angle with leaves attached, one of which is utilized as a trapdoor (Wishart, 1992).

Remarks. The Idiopid genus *Misgolas* was raised by the German taxonomist, Ferdinand Karsch, when in1878 he named and described the new species, *Misgolas rapax*. The spider specimen is the holotype of the type species of the *Misgolas* genus. It is disappointing that the preservation of the specimen has not withstood ravages of time, Main (1985a) describing it as "dried, pinned specimen very shrivelled and difficult to distinguish many features" (Fig. 4K). The spider's condition added to its character poor female gender virtually prevented a positive identity until molecular methods were used. The collector of the type specimen was Edward Damel, a professional German collector, who at one time was based in Sydney, NSW, from May 1874 to February, 1875. During this time it is expected that this spider had been collected from Gerringong or possibly from Kiama, NSW.

Karsch gave no indication of the derivation of the names "Misgolas" or "rapax". A person named Misgolas was a Greek homosexual man known from ancient Greek records and the word "rapax" is believed to translate as "predator". Ferdinand Karsch himself wrote extensively on homosexual affairs quite apart from his arachnology work.

Misgolas robertsi (Main & Mascord, 1974)

Figs 5A–I, 14B

Dyarcyops robertsi Main & Mascord, 1974: 15–21.
Misgolas robertsi.–Main, 1985a: 33, 34, 53, 57; Main, 1985b: 25; Wishart, 1992: 271–273.

Material examined. NEW SOUTH WALES: holotype ♀, AMS KS12, Minnamurra Falls, Kiama, NSW (34°37'S 150°44'E), 12 Oct. 1964, R.M. Mascord. AMS KS22371 ♂, *Scalloway*, Willow Vale, Gerringong, NSW (34°44'11"S 150°47'23"E), 2 May 1986, GW. ♂, AMS KS22399, Mt. Terry nr Albion Park, NSW. (34°35'55"S 150°46'57"E), 27 Nov. 1995, P Cashin.

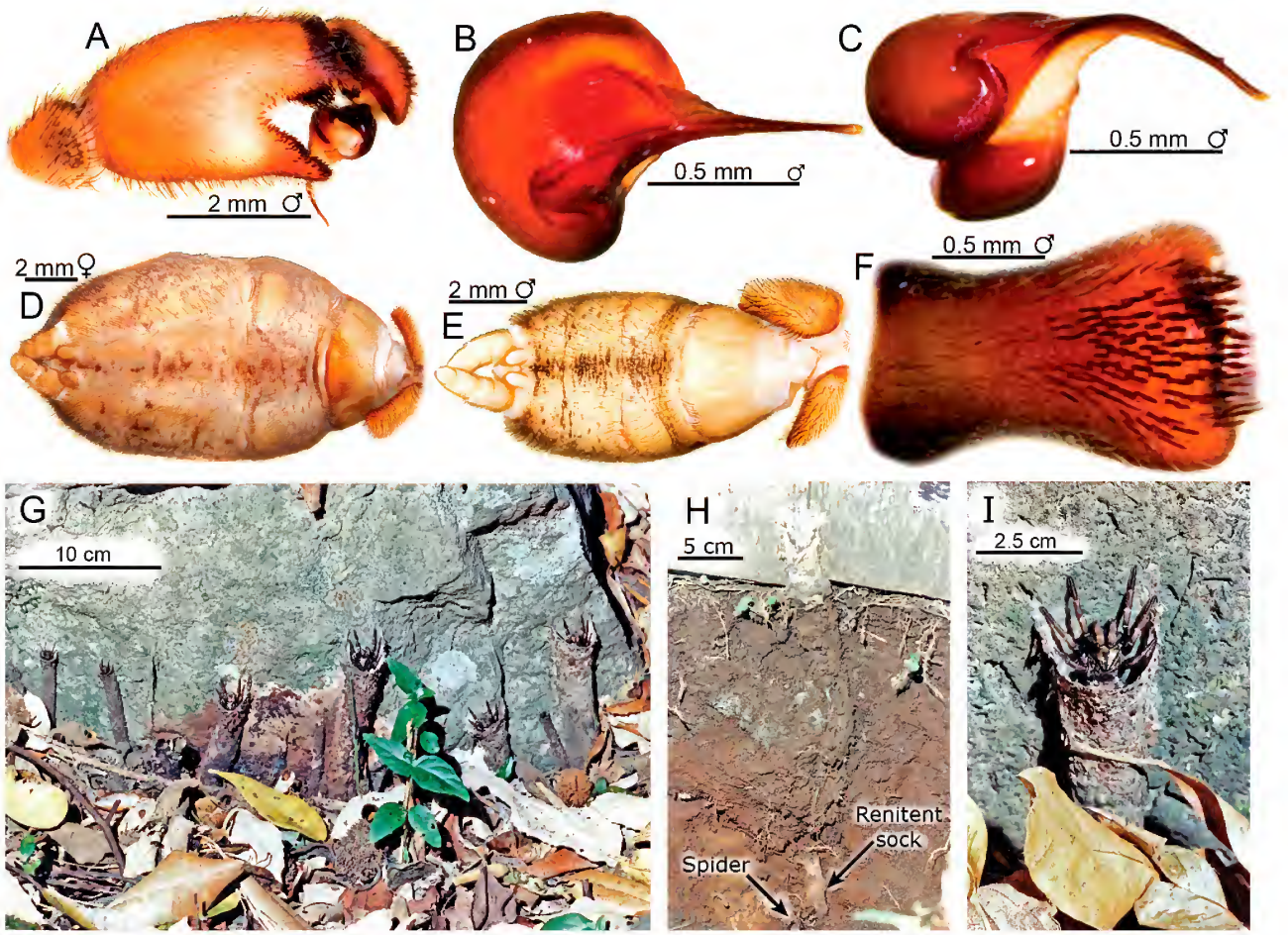

Fig. 5. *Misgolas robertsi.* *(A–C, E,F)* ♂, AMS KS22371. *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(E)* venter. *(F)* cymbium dorsal. *(D)* ♀, holotype AMS KS12, venter. *(G,I)* burrow aerial tubes at Willow Vale nr Gerringong, *(G)* group of burrows. *(I)* burrow entrance, spider in foraging position. *(H)* exposed complete burrow at Kiama.

Diagnosis. In male & female: medium sized brown spiders, prominent dark brown lateral smudges on anterior limbs; retrodorsal surface of metatarsi IV lack spines. Venter pallid with dark brown speckles concentrated in distinctive median band (Fig. 5D,E). In female: carapace length c. 7.5–11.3. In male: carapace length c. 7.5–8.1. Embolus of bulb with small, dorsal, apically right angled triangular apophysis placed about mid-way; retrolateral embolic flange with about eight fine folds, edge straight (Fig. 5B,C). Conformation of palp as figured (Fig. 5A); cymbium dorsal spines in dense cluster, skewer shaped (Fig. 5F).

Distribution and natural history. (Figs 5G–I, 14B) Prolific population at Willow Vale 3 km West of Gerringong; rare at the type locality and nearby localities of Mt. Terry and Kiama. Burrow entrance by aerial tube (Wishart, 1992) (Fig. 5G,I); underground tube terminated by white renitent sock (Fig. 5H). Mature male spiders wander during summer and late autumn (Wishart, 1993).

Misgolas phippsi n.sp.

Figs 6A–G, 14A

Type material. HOLOTYPE ♂, AMS KS7688, Mollymook, NSW (35°20'S 150°29'E), 19 May 1981, J. Sheehan.

Other material examined (most in poor condition). NEW SOUTH WALES: ♂♂ AMS KS1339, Sussex Inlet South, NSW (35°10'S 150°36'E), 7 Mar. 1978, W.K.Jones. AMS KS44343, Greenwell Pt., 82 Greenwell Pt. Road, (34°54'S 150°44'E), 23 Apr.1991, Wayne Moore. AMS KS48695, AMS KS48696 and AMS KS48697, all Erowal Bay, N.S.W., nr. St Georges Basin (35°06'S 150°39'E), collected "prior to last few years" (c. 1990), I. Hammer.

Diagnosis. In male: Medium sized dark brown spider, carapace length c. 7.0–9.0, retrodorsal surface of metatarsus IV with at least one spine (Fig. 6G); venter pale with dense distribution of small dark brown markings most concentrated between book lungs and posterior area immediately adjacent to PMS as figured (Fig. 6D). Spines absent on all tarsi. Palpal bulb (Fig. 6B,C) retrolateral embolic flange with 5 major folds, 2–3 minor folds; embolus narrow, with small, low, subdistal, dorsal apophysis. Cymbium (Fig. 6E) with many closely concentrated acicular spines arising from distal quarter of dorsal surface. Conformation of palpal tibia as figured (Fig. 6A); tibia excavation surface chitinized, tibial excavation mound, pallid, prominent (Fig. 6F). Female not known.

Description

Male holotype (Fig. 6A–G). *Size*. Carapace length 7.00, width 5.83. Abdomen length 7.00, width 5.03. — *Colour*. In alcohol chelicerae, carapace and proximal limb segments dark brown, distal leg segments lighter brown; generally

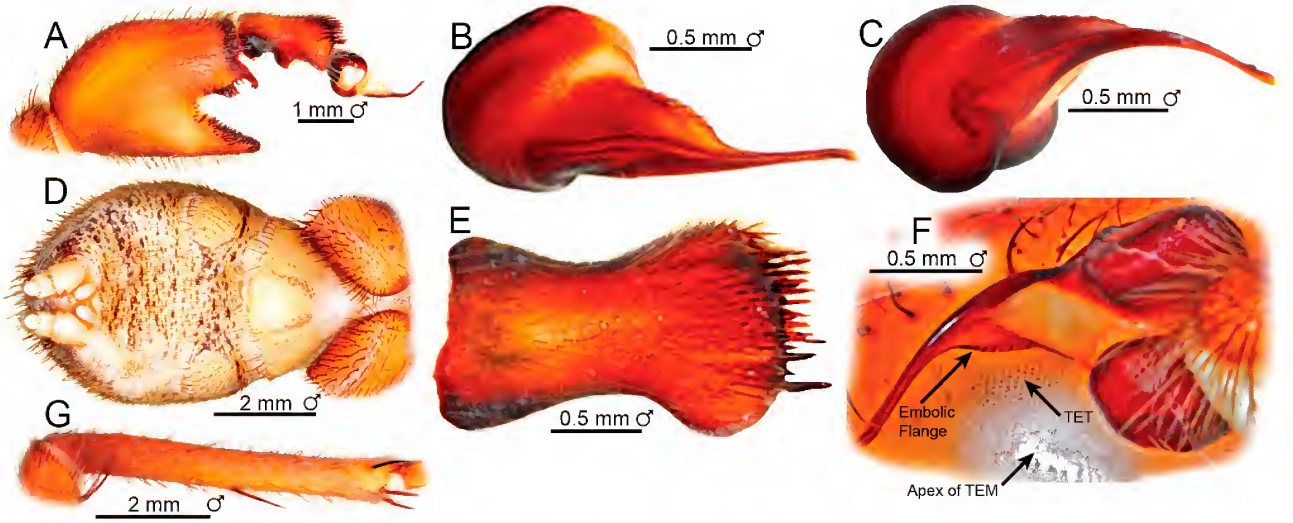

Fig. 6. *Misgolas phippsi* n.sp. *(A–G)* ♂, holotype AMS KS7688: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* venter. *(E)* right cymbium dorsal. *(F)* right palpal tibia excavation ventral. *(G)* right metatarsus IV retrolateral view.

unicolourous. Dark brown lateral limb smudges absent. Fine golden prostrate hairs sparse, present on carapace cephalic and interstrial areas of thorax. Abdomen dorsum distorted, appearing bleached. Venter pallid with dense distribution of small dark brown markings most concentrated between book lungs and posterior area immediately adjacent to PMS (Fig. 6D). — *Carapace*. Edge fringed with black bristles; some smaller bristles encroach onto posterior third of post foveal surface; remainder of carapace with few weak bristles; 5 bristles between PME, 7 on clypeus. Weakly chitinized area on pleuron membrane below clypeus with 7 bristles. Fovea width 1.38, straight, recurved lateral edges, posterior wall divided by partly obscured pitted intrusion. — *Eyes*. Raised on mound. Ocular area darkest brown adjacent to eyes. Anterior width 1.05, posterior width 0.97, length 0.66, width/length ratio 1.59. Line joining posterior edges of ALE transects anterior quarter of AME. Posterior row procurved in front, straight behind. — *Chelicerae*. Rastellum single row of 7(8) spines, 1(2) smaller spines behind. Fang groove and intercheliceral tumescence obscured. — *Labium*. Bulbous. Length 0.79, width 1.05. Labiosternal suture continuous, straight, lateral edges broad. — *Maxillae* c. 38(47) antero-ental, small, subulate cuspules. — *Sternum*. Bulbous, length 3.75, width 3.08. Sigilla all small, round, third pair largest, first and second pairs c. one and a half own diameter from margin, third pair c. twice own diameter from margin. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2(2) short, compact spines; proximal process with compact group of 5(5) curved, pointed spines.

	Palp	I	II	III	IV
Femur	3.75	6.75	6.20	4.79	6.51
Patella	1.72	3.25	3.07	2.39	3.01
Tibia	3.68	4.61	4.24	2.89	5.46
Metatarsus	—	5.47	4.79	4.17	6.08
Tarsus	1.90	3.07	2.82	2.58	3.19
Total	11.05	23.15	21.12	16.82	24.25

Palp. (Fig. 6A,E) Distal half of cymbium d surface with many closely concentrated, acicular, inclined spines. RTA stout, non-swollen; d surface covered with short, pointed spines; suspended brush of c. 10 longer curvilinear spines with few scattered short spines suspended from tibial excavation rv edge terminated by hooked DTA. Tibial excavation surface chitinized; pallid TEM prominent adjacent to RTA, pl surface with prominent TET (Fig. 6F). — *Bulb*. (Fig. 6B,C) Length 2.00. Embolic rl flange edge curved, with 5 major folds, 3 minor folds. Embolus narrow, almost straight, with small, low, subdistal, dorsal apophysis; length from embolic apophysis to embolus tip (a) 0.13; length from embolic flange terminus to embolus tip (f) 0.56; a/f ratio 0.23. — *Scopula*. Complete on tarsi I and II; sparse, complete on tarsi III and IV; metatarsi I and II sparse, incomplete; metatarsi III weak distal remnant; absent on metatarsi IV. — *Trichobothria*. Palp: tarsi 9, tibia pd 6, rd 6. Leg I: tarsi 12, metatarsi 14, tibia pd 6, rd 6. Leg II: tarsi 12, metatarsi 11, tibia pd 6, rd 6. Leg III: tarsi 10, metatarsi 10, tibia pd 5, rd 6. Leg IV: tarsi 12, metatarsi 13, tibia pd 6, rd 6. — *Leg spination*. Leg I: metatarsi v 01002; tibia v 7 scattered, pd 010. Leg II: metatarsi v 01003; tibia v 6 scattered, pl 00110, patella pd 2(1). Leg III: metatarsi v 6 scattered, pd 0010110, rd 0010100; tibia v 0113, pd 00110, rd 00110; patella pd 5. Leg IV: metatarsi v 8 scattered, rd 000010 (Fig. 6G); tibia v 6 scattered. — *Abdomen*. Dorsum with sparse cover long, erect, brown bristles with fine, underlying setae. Lateral surfaces and venter with dense cover of long fine hairs.

Etymology. The species is named in recognition of friend and colleague, Dr R. Jon Phipps of Kiama, NSW.

Distribution and natural history (Fig. 14A) This species is known from Mollymook (the type locality), Sussex Inlet South (35°10'S 150°36'E), Erowal Bay (35°06'S 150°39'E) and Greenwell Point (34°54'S 150°44'E). All localities are within the narrow coastal plain extending from Mollymook to the Shoalhaven River entrance at Greenwell Point, a linear distance of 51 km. The limited information available indicates mature male spiders wander during April and May each year. The burrow is not known.

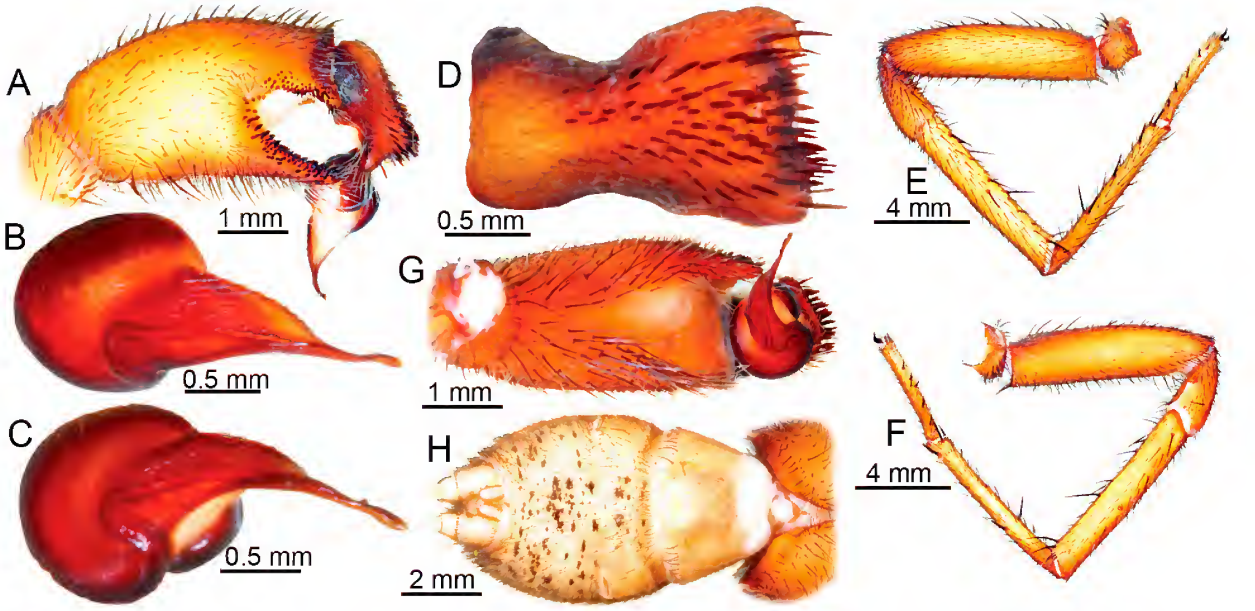

Fig. 7. *Misgolas kampenae* n.sp. *(A–H)* ♂, holotype AMS KS3364: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* right cymbium dorsal. *(E,F)* right leg IV: *(E)* prolateral, *(F)* retrolateral. *(G)* right palpal tibia excavation ventral. *(H)* venter.

Misgolas kampenae n.sp.

Figs 7A–H, 14A

Type material. HOLOTYPE ♂, AMS KS3364 (abdomen dorsum discoloured, right palpal femur missing), Benandarah State Forest, c. 8 km north of Batemans Bay, NSW (35°40'S 150°14'E), pitfall trap in leaf litter, field No. 1578, set 14 June, collected 12 July 1979, C. Horseman.

Other material examined. NEW SOUTH WALES: ♂♂ AMS KS1727, Kioloa State Forest, Forest Drive 15 km north of Batemans Bay, NSW (35°37'S 150°16'E), pitfall trap in leaf litter, Field No. 1181, set 14 Aug., collected 7 Sep. 1978, C. Horseman. AMS KS2902, Kioloa State Forest rest area, 16 km north of Batemans Bay (35°36'S 150°15'E), 9 Apr. 1979, C. Horseman. AMS KS3836, Kioloa State Forest, Forest Drive 16 km north of Batemans Bay (35°37'S 150°16'E), 28 Jun. 1979, C. Horseman. AMS KS3862, Kioloa State Forest, Forest Drive 15 km north of Batemans Bay (35°37'S 150°16'E), 6 Jul. 1979, C. Horseman. AMS KS65064, Bodalla State Forest, Orange Ridge Road, nr. Bodalla, NSW (36°16'55"S 149°53'31"E), 12 Mar. 1999, L. Wilkie, R. Harris & H. Smith (South East Forest Survey CBCR003-086).

Diagnosis. In male: Medium sized brown spider, carapace length c. 6–7.5, retrodorsal surface of metatarsus IV with at least one spine (Fig. 7F); venter pale with dark brown maculations forming pattern, most concentrated in median band (Fig. 7H). Spines absent on tarsi I and II; tarsi IV with bilateral rows spines adjacent to weak scopula (Fig. 7E,F). Palpal bulb (Fig. 7B,C) retrolateral embolic flange with c. 7–9 distinct folds; embolus with blunt dorsal apophysis placed c. midway between embolic flange and embolus tip; tip from d aspect sinuous, flattened vertically. DTA small, hooked; conformation of palpal tibia as figured (Fig. 7A). Female not known.

Description

Male holotype (Fig. 7A–H). *Size*. Carapace length 7.49, width 6.69. Abdomen length 7.55, width 5.03. — *Colour*. In alcohol carapace, limbs and chelicerae brown. Some disconnected darker brown smudges on tibia and patella lateral surfaces of legs I and II. Carapace almost bare of golden hairs, more prominent on proximal limb segments. Abdomen dorsum discoloured. Venter pallid, with dark brown maculations most concentrated in median band (Fig. 7H). — *Carapace*. Edge fringed with black bristles which encroach onto posterior half of post foveal surface; few scattered interstrial bristles. Evidence of row of c. 7 black bristles on caput arch (some removed); 4 between PME; 8 on clypeus. Weakly chitonized area on pleuron membrane below clypeus with 4 bristles. Fovea width 1.38, straight, recurved edges, posterior wall lacking pitted intrusion. — *Eyes*. Raised on a mound. Ocular area adjacent to eyes black. Anterior width 1.25, posterior width 1.20, length 0.76, width/length ratio 1.64. Line joining posterior edges of ALE transects anterior quarter of AME. Posterior row straight in front, recurved behind. — *Chelicerae*. Rastellum front row of 6(7) spines, 3(4) smaller spines behind, few receding along pl edge. Fang groove and intercheliceral tumescence obscured. — *Labium*. Bulbous, length 0.83, width 1.15. Labiosternal suture broad, continuous, narrow midway. — *Maxillae* c. 15(14) elongate, pointed antero-ental cuspules, all surmounted by a hair. — *Sternum*. Broad, bulbous, length 4.35, width 3.75. Sigilla first and second pairs small, round, submarginal; third pair much larger, distant from margin. — *Legs*. Tibia I with distal bifid apophysis; distal process with 3(2) squat, blunt, compact spines; proximal process with row of 2(2) longer, curved, blunt spines.

	Palp	I	II	III	IV
Femur	(4.42)	7.84	7.31	6.02	7.84
Patella	2.13	3.82	3.56	2.82	3.43
Tibia	3.83	5.68	5.40	3.68	6.86
Metatarsus	—	5.78	5.65	5.16	7.06
Tarsus	1.78	3.62	3.50	3.44	3.92
Total	12.16	26.74	25.42	21.12	29.11

Palp. (Fig. 7A,D,G) Distal half of cymbium d surface with cover of robust, terete, bluntly pointed, anteriorly inclined spines (Fig. 7D). Digitate RTA d surface covered with short pointed spines which continue around and onto rv edge of tibial excavation terminating at tip of small hooked DTA. Prominent pallid TEM adjacent to RTA (Fig. 7G), pl surface

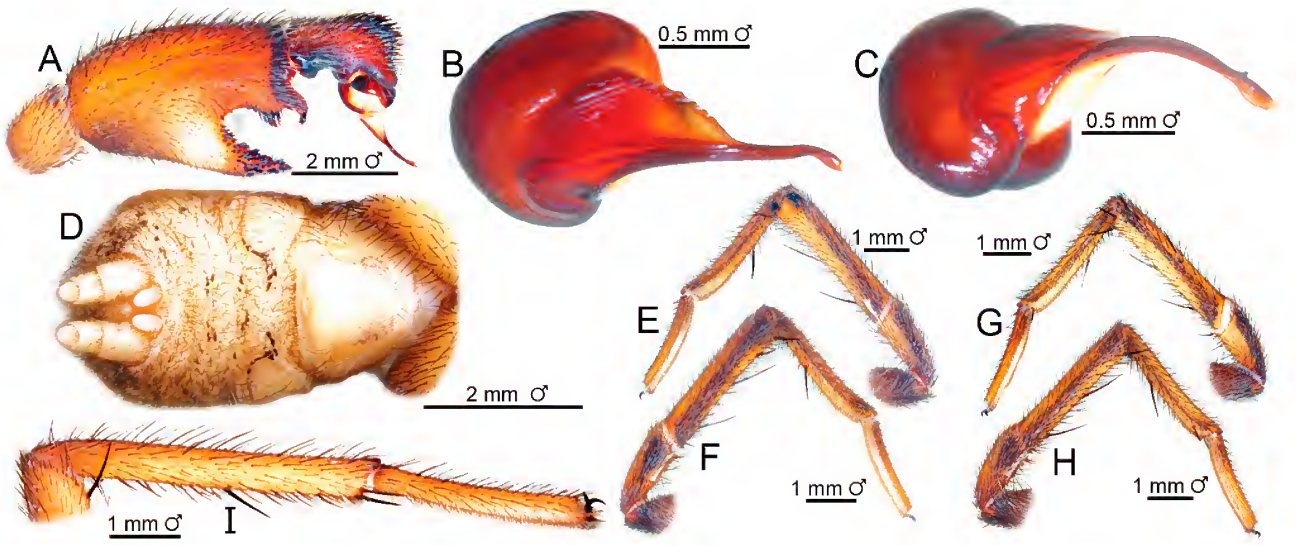

Fig. 8. *Misgolas paulaskewi* n.sp. *(A–I)* ♂, holotype AMS KS22400: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* venter. *(E,F)* right leg I: *(E)* prolateral, *(F)* retrolateral. *(G,H)* right leg II: *(G)* prolateral, *(H)* retrolateral. *(I)* right leg IV tarsus and metatarsus retrolateral.

with TET. — *Bulb*. (Fig. 7B,C) Length 2.36; length from embolic apophysis to embolus tip (a) 0.26; length from embolic flange terminus to embolus tip (f) 0.46; a/f ratio 0.56. Embolic rl flange with 9 major folds, edge gently curved. Embolus with prominent, blunt, d apophysis placed c. midway between embolic flange and embolus tip; tip from d aspect sinuous, compressed flat in vertical plane. — *Scopula*. Complete on tarsi I and II; incomplete on metatarsi I and II; weak on tarsi III and IV; sparse remnants on metatarsi III and IV. — *Trichobothria*. Palp: tarsi 9, tibia pd 6, rd 6. Leg I: tarsi 13, metatarsi 15, tibia pd 7, rd 7. Leg II: tarsi 13, metatarsi 15, tibia pd 7, rd 6. Leg III: tarsi 11, metatarsi 12, tibia pd 5, rd 7. Leg IV: tarsi 13, metatarsi 17, tibia pd 9, rd 6. — *Leg spination*. Leg I: metatarsi v 0102; tibia v 6 scattered, pl 00110. Leg II: metatarsi rv 0212; tibia v 02111, pd 01110. Leg III: tarsi pv 01000, rv 5 scattered, pd 01000, rl 01000; metatarsi v 13 scattered, pd 001110, rd 0011110; tibia v 9 scattered, pd 0110, rd 0010; patella pd 6. Leg IV (Fig. 7E,F): tarsi pv line of 5, rv line of 7; metatarsi pv 6 scattered, rv 011, rd 01010; tibia v 8 scattered. — *Abdomen*. Anterior face with cover of long, erect, dark brown bristles. All setae and colour lost on pallid dorsum. Venter (Fig. 7H) covered with weak short erect brown bristles.

Etymology. The species is named in recognition of Louise Kampen, technical officer, Australian Museum, Sydney.

Distribution and natural history (Fig. 14A) This species is known from Benandarah State Forest (type locality) near Batemans Bay, New South Wales (Australia), north to Kioloa State Forest (35°37'S 150°16'E) near Kioloa, NSW and south to Bodalla State Forest (36°16'55"S 149°53'31"E) near Bodalla, NSW, localities occupying a linear distance of about 80 km along the coast. The burrow is not known. Limited information indicates mature males wander during the annual period of March to September.

Misgolas paulaskewi n.sp.

Figs 8A–I, 14C

Type material. HOLOTYPE ♂, AMS KS22400, 3 km north-west of Quaama near Bega, NSW (36°27'S 149°50'E), 5 Jul. 1992, Lynne Cook [New South Wales, Australia].

Other material examined ♂, AMS KS2736, Bermagui, NSW, 23 km east of type locality (36°25'S 150°04'E), 24 Apr. 1979, M. Stevenson, [New South Wales, Australia].

Diagnosis. In male: medium sized brown spider, carapace length c. 6.7–8.1, retrodorsal surface of metatarsus IV lack spines (Fig. 8I); venter pallid with some dark brown marks as figured (Fig. 8D); elongate bilateral leg blotches on legs I and II along full lengths of metatarsi, tibia and patella (Fig. 8E–H). Spines absent on tarsi I, II and III and ventral surface of tarsi IV. Palpal bulb (Fig. 8B,C) retrolateral embolic flange with c. 7 prominent folds, c. 2 minor folds; embolus with thornlike dorsal apophysis placed c. one third way from embolus tip; tip from dorsal aspect with prolateral bend. Conformation of palp as figured (Fig. 8A). Female not known.

Description

Male holotype (Fig. 8A–I). *Size*. Carapace length 6.75, width 5.83. Abdomen length 6.45, width 3.93. — *Colour*. In alcohol carapace, limbs and chelicerae brown. Elongate bilateral leg smudges along full lengths of metatarsi, tibia and patella I and II. Carapace covered with prostrate golden hairs. Abdomen dorsum pallid with dark brown maculations, transverse chevrons not evident. Venter pallid with sparse brown marks as figured (Fig. 8D). — *Carapace*. Edge fringed with black bristles; few smaller bristles encroach onto posterior fifth of post foveal surface; rows of small bristles adjacent to striae. Row of c. 16 black bristles on caput arch; 9 between PME; 11 on clypeus. Weakly chitinized area on pleuron membrane below clypeus with some fine golden setae. Fovea width 1.28, straight, deep, posterior wall not divided by pitted intrusion. — *Eyes*. Raised on a mound. Ocular area darker adjacent to

eyes. Anterior width 1.23, posterior width 1.05, length 0.72, width/length ratio 1.71. Line joining posterior edges of ALE tangential to anterior edges of AME. Posterior row straight in front, recurved behind. — *Chelicerae*. Rastellum front row of 7(6) spines, 6(7) smaller spines behind. Fang groove with 6(9) promarginal teeth and 13(10) smaller retromarginal/intermediate row teeth. Pallid intercheliceral tumescence each with a dense tuft of distally inclined brown setae near proximal edge. — *Labium*. Bulbous, length 0.87, width 1.18. Labiosternal suture continuous, narrow midway. — *Maxillae* c. 44(46) antero-ental short blunt cuspules, none surmounted by a hair. — *Sternum*. Bulbous, length 3.83, width 3.12. Front and midrow sigilla small, round, one diameter from margin; left posterior sigilla larger c. one diameter from margin, right sigilla divided into two. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2(2) short compact blunt spines, proximal process with row of 3(3) longer compact curved pointed spines.

	Palp	I	II	III	IV
Femur	4.36	7.12	6.32	5.03	6.82
Patella	1.84	3.32	3.01	3.01	2.95
Tibia	4.18	5.03	4.42	3.07	5.96
Metatarsus	—	4.97	4.54	4.24	6.08
Tarsus	1.90	3.13	1.78	2.88	3.43
Total	12.28	23.57	20.07	18.23	25.24

Palp. (Fig. 8A) Distal half of cymbium d surface with many long attenuate anteriorly inclined spines. RTA midway with small rl swelling; d, rd and small rl swelling surfaces covered with pointed spines. Tibial excavation rv edge with 15 short smaller spines adjacent to a suspended brush of c. 20 longer curved pointed spines; 7 spines terminate hooked DTA. TEM pallid, adjacent to RTA, pl surface with indistinct TET. — *Bulb*. (Fig. 8B,C) Length 2.23; length from embolic apophysis to embolus tip (a) 0.26; length from embolic flange terminus to embolus tip (f) 0.61; a/f ratio 0.42. Embolic rl flange with 7 major folds, 2 minor folds, edge gently curved. Embolus with prominent d thorn-like apophysis placed nearer embolus tip than embolic flange; tip from d aspect with pl bend. — *Scopula*. Complete on all tarsi; sparse incomplete on metatarsi I and II; absent on metatarsi III and IV. — *Trichobothria*. Palp: tarsi 7, tibia pd 5, rd 5. Leg I: tarsi 10, metatarsi 13, tibia pd 7, rd 7. Leg II: tarsi 10, metatarsi 12, tibia pd 6, rd 6. Leg III: tarsi 11, metatarsi 9, tibia pd 5, rd 5. Leg IV: tarsi 10, metatarsi 14, tibia pd 7, rd 7. — *Leg spination*. Leg I: metatarsi rv 010; tibia rv 01112, pl 010. Leg II: metatarsi rv 0010012; tibia v 0113, pd 001010. Leg III: metatarsi v 013, pl 001110, rl 001110; tibia v 0113, pl 0110, rl 0011; patella pd 6. Leg IV: tarsi pl 0110; metatarsi v 5 scattered; tibia v 0112. — *Abdomen*. Dorsum with cover small brown hairs and bristles underlying many erect long brown bristles. Venter covered with long weak erect brown bristles.

Etymology. The species is named in recognition of Paul Askew who, while my neighbour, provided valuable field assistance.

Distribution and natural history (Fig. 14C) This species is known from near the village of Quaama, New South Wales, Australia (type locality), and at the seaside town of Bermagui (36°25'S 150°04'E) NSW, 21 km to the east. The burrow is unknown.

Misgolas rowelli n.sp.

Fig. 9A–H, 14A

Type material. HOLOTYPE ♂, AMS KS51813, Minnamurra, nr Kiama, NSW, in school grounds (34°37'29"S 150°51'08"E), 1 Jun. 2000. PARATYPES ♂♂, AMS KS22398, Minnamurra village, NSW (34°37'S 150°51'E), 15 May 1995, Mrs Kelly; AMS KS50003, Minnamurra village, NSW (34°37'S 150°51'E), 22 May 1997, Paul Askew; AMS KS51796, AMS KS51797 and AMS KS51798, 141 Charles Ave., Minnamurra village, NSW (34°37'S 150°51'E), 16 Apr. 2000, Elizabeth Larborn, from home swimming pool.

Diagnosis. In male medium sized brown spider, carapace length c. 6–7.5; retrodorsal surface of metatarsus IV usually with 1 or 2 spines (Fig. 9E); venter pattern as figured, saturation density various (Fig. 9F–H). Palpal bulb (Fig. 9B,C) retrolateral embolic flange with 6 or 7 folds, margin gently curved; embolus with small, thornlike, dorsal apophysis distant from embolus tip. Cymbium with weak, long, acicular spines arising from distal third of dorsal surface (Fig. 9D). Conformation of palpal tibia as figured (Fig. 9A). Female not known.

Description

Male holotype (Fig. 9A–E). *Size*. Carapace length 7.06, width 5.59. Abdomen length 6.45, width 3.99. — *Colour*. In alcohol chelicerae and abdomen dorsum dark brown, carapace and limbs brown. Weak, dark brown smudges on rl surfaces of patella and tibia I and patella II. Fine pallid prostrate hairs cover carapace. Abdomen dorsum divided by six precise centrally divided transverse pallid lines. Venter pallid with cover of small dark speckles most concentrated immediately adjacent to PMS (Fig. 9F). — *Carapace*. Edge fringed with black bristles which encroach onto posterior quarter of post foveal surface; line of 3 fine black bristles on caput arch, none between PME, 18 between ALE and on clypeus. Some weak bristles on non-chitinized pleuron membrane below clypeus. Fovea width 1.13, straight, recurved lateral edges, posterior wall basally, centrally divided by minute pitted intrusion. — *Eyes*. Raised on mound. Ocular area varying shades of dark brown. Anterior width 1.13, posterior width 0.97, length 0.67, width/length ratio 1.69. Line joining posterior edges of ALE transects anterior sixth of AME. Posterior row straight. — *Chelicerae*. Rastellum single row of 6(6) small spines. Fang groove with 8(9) large promarginal teeth and 15(12) small retromarginal/intermediate row teeth. Intercheliceral tumescence pallid, extending behind proximal teeth of fang groove; surface with complex cover of setae. — *Labium*. Bulbous. Length 0.69, width 0.97. Labiosternal suture continuous, broadening laterally. — *Maxillae* c. 57(48) antero-ental, small, ovoid cuspules. — *Sternum*. Length 3.62, width 2.82. Sigilla small, sub-round, gradually enlarging from first to third pairs, each their own diameter distant from margin. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2(2) short, compact spines; proximal process with 3(3) long, sinuous, pointed spines.

	Palp	I	II	III	IV
Femur	3.87	6.57	6.02	4.79	6.26
Patella	1.78	3.25	2.95	2.27	2.95
Tibia	3.99	4.79	4.11	2.82	5.34
Metatarsus	—	5.22	4.42	3.99	5.77
Tarsus	1.90	3.07	2.76	2.52	3.07
Total	11.54	22.90	20.26	16.39	23.39

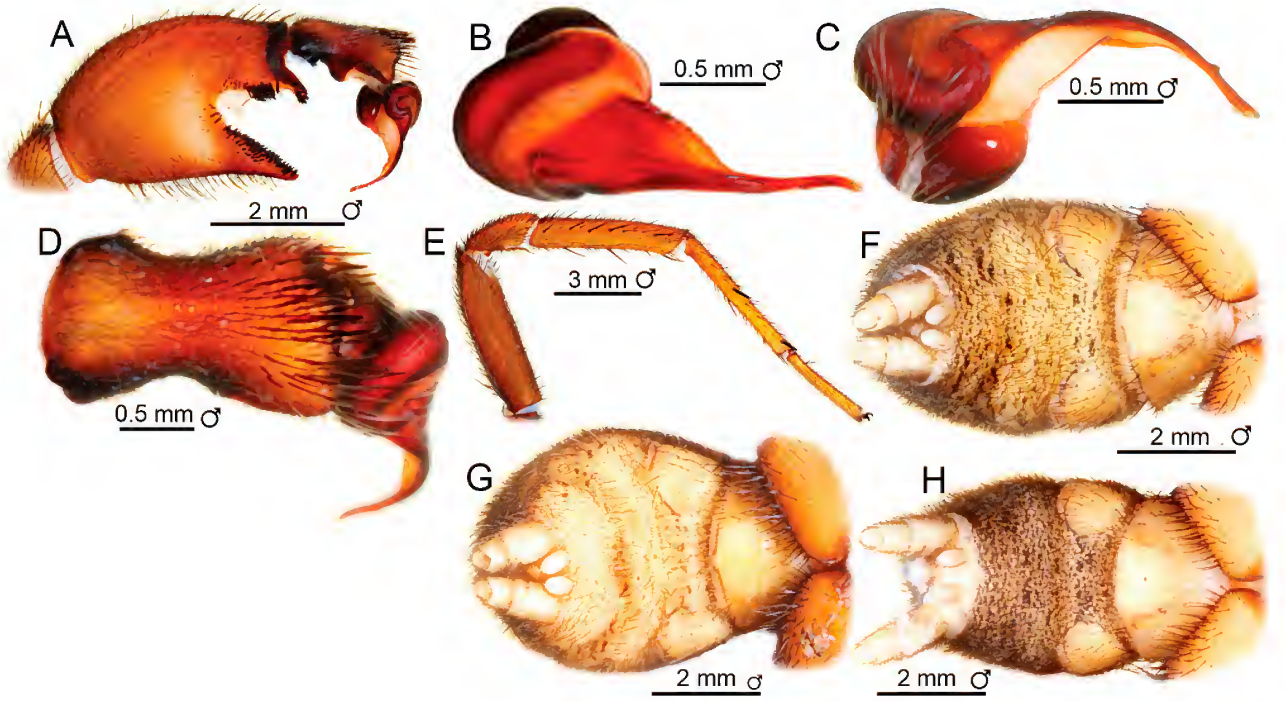

Fig. 9. *Misgolas rowelli* n.sp. *(A–F)* ♂, holotype AMS KS51813: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* cymbium. *(E)* right leg IV retrolateral. *(F)* venter. *(G)* ♂, paratype, AMS KS22398, venter. *(H)* ♂, paratype, AMS KS51798, venter.

Palp. (Fig. 9A) Distal third of cymbium d surface with c. 25 weak, long, acicular spines, steeply inclined forward (Fig. 9D). RTA d surface flat, covered with many short, pointed spines. Tibial excavation rv edge suspends brush of c. 16 longer spines; edge terminated by hooked DTA, tip covered by c. 12 short spines. Pallid TEM prominent, pl surface with discernable TET. Tibial excavation surface weakly chitinized. — *Bulb*. (Fig. 9B,C) Length 2.10. Embolic rl flange edge gently curved, with 6 folds. Embolus with thornlike, distally pointed, dorsal apophysis distant from prolaterally curved embolus tip. Length from embolic apophysis to embolus tip (a) 0.28; length from embolic flange terminus to embolus tip (f) 0.61; a/f ratio 0.46. — *Scopula*. Complete on all tarsi; metatarsi I and II incomplete; weak distal remnant on metatarsi III and IV. — *Trichobothria*. Palp: tarsi 10, tibia pd 6, rd 6. Leg I: tarsi 14, metatarsi 12, tibia pd 6, rd 6. Leg II: tarsi 12, metatarsi 12, tibia pd 6, rd 6. Leg III: tarsi 11, metatarsi 10, tibia pd 5, rd 6. Leg IV: tarsi 12, metatarsi 14, tibia pd 6, rd 7. — *Leg spination*. Leg I: metatarsi v 0102; tibia v 0112, pd 010. Leg II: metatarsi v 011003; tibia v 01103, pl 00110, pd 010. Leg III: metatarsi v 022, pd 01010, rd 001110; tibia v 0113, pl 0110, rl 00110; patella pd 5. Leg IV: metatarsi v 00223, rd 001010; tibia v 0222. — *Abdomen*. Dorsum covered with erect, long, brown bristles with understory of fine pallid setae. Venter covered by weak brown bristles. Fine pallid setae on venter and lateral surfaces.

Etymology. The species is named in recognition of Associate Professor David M. Rowell, geneticist and gifted teacher at the Australian National University.

Distribution and natural history (Fig. 14A) This species known only from type locality, the seaside village of Minnamurra, NSW. Limited data indicates mature males wander during the annual period of April to June. The burrow is not known.

Misgolas tannerae n.sp.

Figs 10A–I, 14C

Type material. HOLOTYPE ♂, AMS KS38699, Minnamurra Falls, nr Jamberoo, NSW (34°37'S 150°44'E), 15 Jun. 1966 (reared from juvenile captured 12 Nov. 1964). ALLOTYPE ♀, AMS KS38697, 12 Nov. 1964, locality details as for holoype. Paratypes ♂♂, AMS KS38556, AMS KS38564 & AMS KS38698 all details as for holotype. PARATYPES ♀♀, AMS KS38620, Minnamurra Lane, Jamberoo (34°38'58"S 150°46'33"E), 9 Aug. 1991, Peter Butler; AMS KS69971, Minnamurra Falls Reserve, excavated from roadside outside entrance (34°37'S 150°44'E), 14 Jun. 2003, GW & S. Jordan.

Diagnosis. Medium (male carapace length, c. 6.5–8) to large (female carapace length, c. 8–11.6) sized brown spiders (Fig. 10I); retrodorsal surface of metatarsus IV without spines (Fig. 10F); abdomen lateral surfaces with scattered, distinctive dark brown spots (Fig. 10D,G); venter entirely pallid devoid of markings (Fig. 10E,H). In male: palpal bulb (Fig. 10B,C) retrolateral embolic flange with 4 folds, margin curved; embolus with thornlike, distally pointed, dorsal apophysis distant from prolaterally curved embolus tip. Cymbium with weak, long, acicular spines arising from distal half of dorsal surface. Retrolateral tibial apophysis abruptly compressed c. midway, distally digitate; conformation of palpal tibia as figured (Fig. 10A).

Description

Male holotype (Fig. 10A–E). *Size*. Carapace length 7.37, width 6.02. Abdomen length 8.04, width 5.49. — *Colour*. In alcohol chelicerae, carapace and limbs brown; generally unicolourous. Dark brown lateral limb smudges indistinct. Fine pallid prostrate hairs cover interstrial areas of thorax. Brown maculation of dorsum divided by c. six transverse pallid lines. Small precise dark brown spots scattered on abdomen lateral surfaces (Fig. 10D); venter entirely pallid

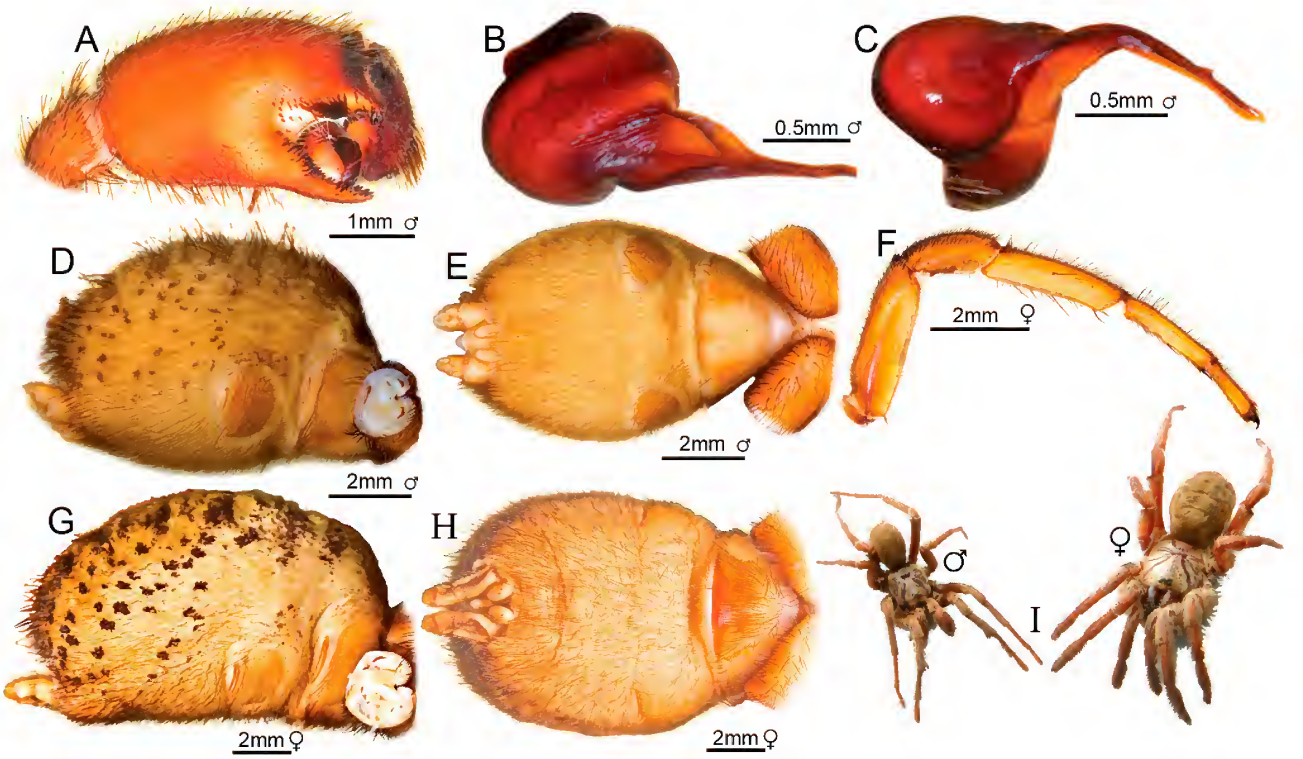

Fig. 10. *Misgolas tannerae* n.sp. *(A–E)* ♂, holotype AMS KS38699. *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* abdomen right side *(E)* venter. *(F–H)* ♀, allotype AMS KS38697. *(F)* right leg IV retrolateral. *(G)* abdomen right side. *(H)* venter. *(I)* ♂ holotype and ♀ allotype spiders relative sizes, approximately life size.

(Fig. 10E). — *Carapace*. Edge fringed with black bristles which encroach onto posterior edge of post foveal surface; line of 5 black bristles on caput arch, sparse on remainder of carapace surface, none between PME, 8 on clypeus and weakly chitinous pleuron membrane below clypeus. Fovea width 1.33, straight, recurved lateral edges, lacking pitted intrusion on posterior wall. — *Eyes*. Raised on mound. Ocular area immediately adjacent to eyes & between PME black. Anterior width 1.15, posterior width 1.10, length 0.70, width/length ratio 1.64. Line joining posterior edges of ALE transects anterior quarter of AME. Posterior row recurved in front and behind. — *Chelicerae*. Rastellum single row of 5(6) spines, 1(1) behind. Fang groove with 8(8) large promarginal teeth and 9(12) small retromarginal/intermediate row teeth. Intercheliceral tumescence small, pallid, not raised. — *Labium*. Bulbous. Length 0.77, width 1.02. Labiosternal suture broad, centrally divided. — *Maxillae* c. 22(24) antero-ental, small, subulate cuspules surmounted by a hair. — *Sternum*. Length 3.82, width 3.19. Sigilla small, sub-round; anterior pair own diameter, mid pair twice its diameter and posterior pair thrice its diameter distant from margin. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2 short, compact spines (1 acute, 1 blunt); proximal process with 3(2) pointed spines.

	Palp	I	II	III	IV
Femur	4.05	7.06	6.75	4.92	7.18
Patella	1.66	3.38	3.01	2.52	3.13
Tibia	3.87	4.61	4.67	3.38	6.02
Metatarsus	—	4.85	4.67	4.36	6.26
Tarsus	1.90	2.52	2.52	2.70	3.19
Total	11.48	22.42	21.62	17.88	25.78

Palp. (Fig. 10A) Cymbium with bilateral placed long fine pallid setae; distal third of d surface with many closely concentrated, acicular, forward inclined long light brown spines. RTA proximally broad, abruptly reduced c. midway, becoming digitate; d surface covered with short, pointed spines. Tibial excavation rv edge suspends extensive brush of long curvilinear spines; edge terminated by hooked DTA, tip covered by c. 30 short spines. Pallid TEM prominent, contiguous with RTA, pl surface with discernable TET. Tibial excavation surface weakly chitinized. — *Bulb*. (Fig. 10B,C) Length 2.15. Embolic rl flange edge curved, with 4 prominent folds. Embolus, with thornlike, distally pointed, dorsal apophysis distant from prolaterally curved embolus tip. Length from embolic apophysis to embolus tip (a) 0.40; length from embolic flange terminus to embolus tip (f) 0.74; a/f ratio 0.53. — *Scopula*. Complete on all tarsi; metatarsi I and II incomplete; weak distal remnant on metatarsi III and IV. — *Trichobothria*. Palp: tarsi 10, tibia pd 6, rd 6. Leg I: tarsi 11, metatarsi 17, tibia pd 7, rd 8. Leg II: tarsi 12, metatarsi 13, tibia pd 7, rd 7. Leg III: tarsi 13, metatarsi 13, tibia pd 7, rd 7. Leg IV: tarsi 12, metatarsi 13, tibia pd 7, rd 8. — *Leg spination*. Leg I: metatarsi v few bristles; tibia v 01112, pd 0110. Leg II: metatarsi rv 0100; tibia v 0113, pd 00110. Leg III: metatarsi v 0113, d 012220; tibia v 0113, pl 010, rl 00110; patella pd 7. Leg IV: metatarsi v 9 scattered; tibia v 7 scattered spines and spinules, rd 011110. — *Abdomen*. Dorsum covered with erect long, brown bristles. Prostrate hairs on lateral surfaces and venter.

Female allotype (Fig. 10F–H). *Size*. Carapace length 11.56, width 8.62. Abdomen length 13.46, width 9.49. — *Colour*. In alcohol chelicerae, carapace and limbs light brown; generally unicolourous. Dark brown indistinct bilateral limb smudges

on femora, patella and tibia of palps and legs I and II. Fine pallid prostrate hairs provide dense golden sheen to caput and interstrial areas of thorax. Dark brown maculated pattern on dorsum. Small precise dark brown spots scattered on abdomen lateral surfaces (Fig. 10G). Venter entirely pallid (Fig. 10H). — *Carapace*. Edge fringed with pallid hairs. Line of 7 fine dark and 3 larger median bristles on caput arch; few bristles between PME; c. 14 bristles on clypeus and pleuron membrane below clypeus. Fovea width 2.69, straight; posterior wall not pitted. — *Eyes*. Placed on a low mound. Area immediately adjacent to eyes dark brown. Anterior width 1.79, posterior width 1.66, length 1.05, width/length ratio 1.79. Line joining posterior edges of ALE tangential to anterior edges of AME. Posterior row straight in front, recurved behind. — *Chelicerae*. Rastellum row of 7(6) spines; c. 8(5) smaller spines behind. Fang groove with c. 9(9) promarginal teeth and c. 16(15) small retromarginal/intermediate row teeth, partly masked by long orange setae. — *Labium*. Bulbous, length 1.61, width 2.12. Labio-sternal suture narrow, continuous. — *Maxillae* c. 60(60) short rounded antero-ental cuspules partly masked by long orange setae. — *Sternum*. Length 6.51, width 5.10. Sigilla anterior pair small, round, 1 diameter from margin; mid-pair larger, ovate, 1 length from margin; posterior pair largest, ovate-elongate, 1 length from margin. — *Legs*:

	Palp	I	II	III	IV
Femur	6.70	8.62	7.94	6.20	8.72
Patella	3.81	5.00	4.50	4.11	5.39
Tibia	4.35	5.59	4.90	3.13	7.15
Metatarsus	—	4.90	4.21	3.99	6.08
Tarsus	4.85	2.94	2.65	2.89	3.04
Total	19.71	27.05	24.20	20.32	30.38

Scopula. Dark grey in colour. Dense, complete v cover on palpal tarsi and tarsi & metatarsi I; less dense, complete on tarsi II, incomplete on metatarsi II; remnant on tarsi III, absent on leg IV. — *Trichobothria*. Palp: tarsi 16, tibia pd 9, rd 9. Leg I: tarsi 26, metatarsi 21, tibia pd 10, rd 12. Leg II: tarsi 19, metatarsi 20, tibia pd 11, rd 10. Leg III: tarsi 22, metatarsi 21, tibia pd 8, rd 11. Leg IV: tarsi 17, metatarsi 24, tibia pd 10, rd 12. — *Leg spination*. Palp: tarsi pv 1 proximal, rv 2 proximal; tibia pv 8 scattered, rv 4 scattered. Leg I: metatarsi pv 01, rv 0011002; tibia v 8 scattered. Leg II: tarsi 00010, metatarsi v 7 scattered; tibia v 7 scattered, pl 0110. Leg III: tarsi v 11 scattered; metatarsi v 8 scattered, pd 0111110, rd 001110; tibia v 6 scattered, pl 0110, rl 0110; patella pd 11. Leg IV: tarsi v 11 scattered; metatarsi v 12 scattered. — *Abdomen*. Dorsum sparsely covered with posteriorly inclined, brown bristles. Prostrate, weak, fine hairs on lateral surfaces; venter covered densely with longer hairs. — *Genitalia*. Sclerotized lip of epigynum straight.

Etymology. The species is named in honour of Miss Janice Tanner, one time principal of the Berry Primary School, the grounds of which are the type locality of *M. gwennethae* n.sp. Her eagerness in facilitating the provision of specimens and behaviour information together with enthusiasm for the development of pupil interest is recognized.

Distribution and natural history (Fig. 14C) This species known only from type locality and nearby township of Jamberoo. The largest burrows readily identified amongst garden mulch and grassed areas; entrance up to 2 cm diameter; lip attached by silk to leaves and forest debris such that entrance is supported about a centimetre above ground level. Below ground level the burrow is lined with fragile silken tube to depth of c. 20 cm.

Misgolas shawi n.sp.

Fig. 11A–G, 14B

Type material. HOLOTYPE ♂, AMS KS12506 (abdomen distorted and discoloured, sternum bilaterally compressed and distorted), Bega, NSW (36°41'S 149°51'E), 23 May 1983, R. Thompson [New South Wales, Australia].

Other material examined. NEW SOUTH WALES: ♀, AMS KS36580, Candello, NSW (36°46'S 149°42'E), 17 May 1973, M. Gray.

Comparing the appearance of this latter female specimen with the neighbouring (17 km apart) male holotype *M. shawi* n.sp. there is suspicion of synonymy, e.g., absence of spines on rd surface of metatarsi IV and venter entirely pallid. Contradicting this is the elongate bilateral leg blotches on legs I and II along full length of relevant leg segments. Until more specimens are collected from the area, a definite species assignment cannot be made for the female specimen.

Diagnosis. In male: Medium sized brown spider, carapace length c. 6, retrodorsal surface of metatarsus IV without spines (Fig. 11G); venter entirely pallid (Fig. 11D); some disconnected dark brown smudges on leg I tibia and patella lateral surfaces (Fig. 11E–F). Spines absent on tarsi I and II (Figs.11E,F), numerous on ventral surface of tarsi III and IV. Palpal bulb (Fig. 11B,C) retrolateral embolic flange with c. 5 major folds, c. 2 minor folds; embolus with thornlike dorsal apophysis placed nearer embolic flange than embolus tip; tip from dorsal aspect with prolateral bend. Conformation of palpal tibia as figured (Fig. 11A). Female not known.

Description

Male holotype (Fig. 11A–G). *Size*. Carapace length 6.02, width 5.40. Abdomen length 5.83, width 4.30. — *Colour*. In alcohol carapace, limbs and chelicerae brown. Some disconnected darker brown smudges on tibia and patella lateral surfaces of legs I and II. Carapace and limbs with very few sparse golden hairs. Abdomen dorsum discoloured. Venter pallid, wrinkled, no dark pattern perceived (Fig. 11D). — *Carapace*. Edge fringed with black bristles which encroach onto posterior half of post foveal surface; very few scattered interstrial bristles. Evidence of row of c. 6 black bristles on caput arch (some removed); 4 between PME; 2 large bristles and 5 other setae on clypeus. Weakly chitinized area on pleuron membrane below clypeus with 5 bristles and few fine setae. Fovea width 1.33, straight, recurved edges, deep, posterior wall centrally divided by small pitted intrusion. — *Eyes*. Raised on a mound. Ocular area darker adjacent to eyes. Anterior width 1.18, posterior width 0.96, length 0.70, width/length ratio 1.69. Line joining posterior edges of ALE transects anterior third of AME. Posterior row straight in front, recurved behind. — *Chelicerae*. Rastellum single row of 7(7) weak spines. Fang groove with 7 promarginal teeth and 13 smaller retromarginal/intermediate row teeth. Left fang groove and intercheliceral tumescence obscured. — *Labium*. Bulbous, length 0.79, width 1.20. Labiosternal suture laterally broad, narrow midway. — *Maxillae* c. 37(46) antero-ental short rotund cuspules, none

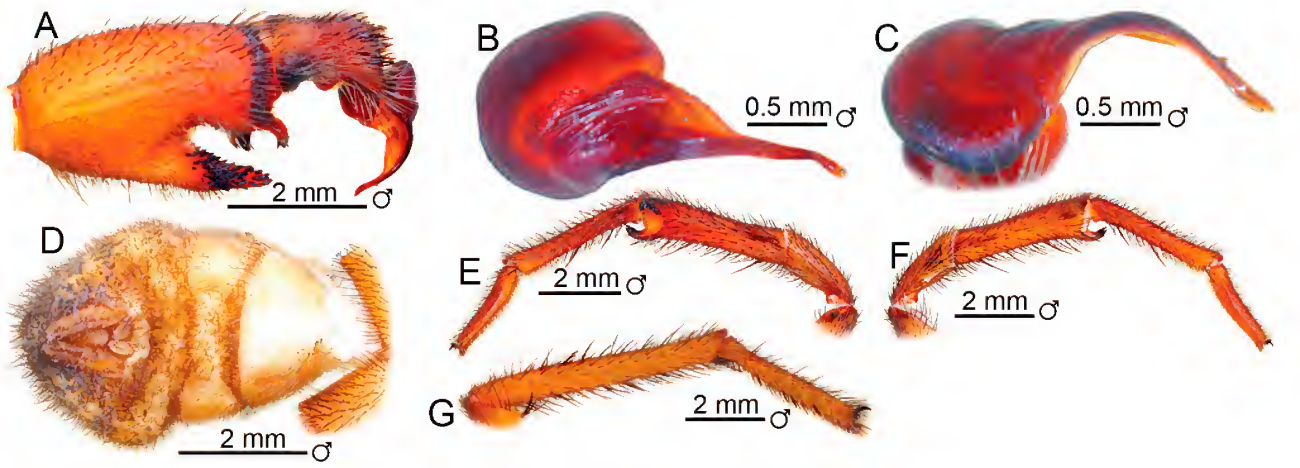

Fig. 11. *Misgolas shawi* n.sp. *(A–G)* ♂, holotype AMS KS12506, *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* venter. *(E,F)* right leg I: *(E)* prolateral, *(F)* retrolateral. *(G)* right leg IV tarsus and metatarsus retrolateral.

surmounted by a hair. — *Sternum*. Bilaterally compressed, distorted. Length 3.52, width 2.01. Sigilla misshapen. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2(2) short compact spines, proximal process with row of 3(3) longer curved pointed spines.

	Palp	I	II	III	IV
Femur	3.95	6.39	6.02	4.79	6.45
Patella	1.87	3.01	2.82	2.33	2.82
Tibia	3.56	4.30	4.05	2.89	5.59
Metatarsus	—	4.48	4.17	3.93	6.20
Tarsus	1.54	2.61	2.64	2.57	3.01
Total	10.92	20.79	19.70	16.51	24.07

Palp. (Fig. 11A) Distal half of cymbium d surface with many long attenuate anteriorly inclined spines. RTA midway with small rl swelling; d, rd and small swelling surfaces covered with pointed spines. Tibial excavation rv edge with 10 short smaller spines progressing distally along edge and increasing in length forming a suspended brush of 11 spines; 6 spines terminate hooked DTA. TEM of right palp collapsed. Both right and left TEMs weakly chitonized; TET not seen. — *Bulb*. (Fig. 11B,C) Length 2.05; length from embolic apophysis to embolus tip (a) 0.38; length from rl flange terminus to embolus tip (f) 0.66; a/f ratio 0.57. Embolic rl flange with 5 major folds and 2 minor folds, edge gently curved. Embolus with prominent d thorn-like apophysis placed nearer embolic flange than embolus tip; tip from d aspect with pl bend. — *Scopula*. Complete and weak on tarsi I and II; small sparse incomplete on metatarsi I and II; absent on legs III and IV. — *Trichobothria*. Palp: tarsi 9, tibia pd 6, rd 5. Leg I: tarsi 13, metatarsi 12, tibia pd 7, rd 7. Leg II: tarsi 11, metatarsi 13, tibia pd 6, rd 7. Leg III: tarsi 13, metatarsi 10, tibia pd 6, rd 7. Leg IV: tarsi 11, metatarsi 12, tibia pd 8, rd 8. — *Leg spination*. Leg I: metatarsi pv 01, rv 0111; tibia rv 0111. Leg II: metatarsi pv 011, rv 02112; tibia v 01112, pv 000010. Leg III: tarsi v 12 scattered, metatarsi v 10 scattered, pl 001110, rl 001110; tibia v 0114, pl 00110, rl 00110; patella pd 2. Leg IV: tarsi pv 14 scattered, rv 4; metatarsi v 14 scattered; tibia v 012. — *Abdomen*. Dorsum with sparse cover of small prostrate bristles underlying many erect long brown bristles. Venter covered with weak short erect brown bristles.

Etymology. The species is named in recognition of Dr David Shaw whose genetic studies over many years has contributed greatly in understanding characteristics of hybrid zone dynamics.

Distribution and natural history (Fig. 14B) This species is known only from the type locality, the town of Bega, New South Wales, Australia. The burrow is not known.

Misgolas horsemanae n.sp.

Figs 12A–K, 14B

Type material. HOLOTYPE ♂, AMS KS2980, Kioloa State Forest Rest Area, 16 km North of Bateman's Bay, NSW (35°36'S 150°15'E), 2 May 1979. Pitfall trap, Field No. 1565, set 23 Apr. collected 17 May 1979, C. Horseman [New South Wales, Australia].

Other material examined. NEW SOUTH WALES: ♂, AMS KS65067, Dampier State Forest, Site 1, Coomarong Road, nr. Kianga, NSW (36°06'46"S 149°59'13"E), 10 Mar. 1999, L. Wilkie, R. Harris & H. Smith (South East Forest Survey CBCR003-070).

Diagnosis. In male: Small sized dark brown spider, carapace length c. 5.3, retrodorsal surface of metatarsus IV with at least 1 spine (Fig. 12K); leg segments generally unicolourous, venter with prominent dark markings forming three or four transverse broken lines on pallid background (Fig. 12E). Spines absent on tarsi I and II (Fig. 12F–I). Palpal bulb (Fig. 12B,C) retrolateral embolic flange edge slightly curved, revolute, entire; embolus narrow, tubular, almost straight, lacking apophysis. Cymbium (Fig. 12D) with few sparse acicular spines arising from distal third of dorsal surface. Conformation of palpal tibia as figured (Fig. 12A); tibia excavation surface pallid, tibial excavation mound reduced to a swelling contiguous with retrolateral tibial apophysis. Female not known.

Description

Male holotype (Fig. 12A–K). *Size*. Carapace length 5.34, width 4.30. Abdomen length 5.16, width 2.89. — *Colour*. In alcohol carapace, chelicerae and all limbs brown, generally unicolourous. Weak leg smudges on lateral surfaces of femora, patella and tibia legs I and II. Fine golden prostrate hairs sparse, present only on carapace

perimeter and proximal leg segments. Abdomen dorsum dark brown, pallid transverse chevrons in bilateral series of eight. Venter with prominent dark markings forming four transverse, broken lines (Fig. 12E). — *Carapace*. Edge fringed with black bristles; some large bristles encroach onto posterior half of post foveal surface; remainder of carapace with few weak bristles; bristles absent between PME, 6 on clypeus. Area on pleuron membrane below clypeus non-chitinous, setae absent. Fovea width 0.87, procurved, deep, recurved lateral edges, posterior wall divided by prominent pitted intrusion. — *Eyes*. Raised on mound. Ocular area black adjacent to eyes, posterior perimeter of PLE excepted. Anterior width 0.87, posterior width 0.85, length 0.54, width/length ratio 1.57. Line joining posterior edges of ALE coincides with anterior edges of AME. Posterior row procurved in front, recurved behind. — *Chelicerae*. Rastellum single row of 5(6) weak spines, c. 4(4) bristles. Fang groove and intercheliceral tumescence obscured. — *Labium*. Short, broad, bulbous. Length 0.56, width 0.90. Labiosternal suture continuous, narrowed centrally. — *Maxillae* c. 6(7) antero-ental, long pointed cuspules. — *Sternum*. Bulbous, length 2.76, width 2.15. Sigilla all small, round, equal in size, front and mid pairs c. own diameter from margin, posterior pair c. twice own diameter from margin. — *Legs*. Tibia I with distal bifid apophysis; distal process with 2(2) short, compact, straight, pointed spines; proximal process with row of 3(3) curved, pointed spines.

	Palp	I	II	III	IV
Femur	2.61	4.97	4.61	3.95	5.16
Patella	1.22	2.46	2.33	1.86	2.39
Tibia	2.45	3.68	3.32	2.65	4.67
Metatarsus	—	3.87	3.56	3.52	4.91
Tarsus	1.19	2.76	2.40	2.25	2.83
Total	7.47	17.74	16.22	14.23	19.96

Palp. (Fig. 12A,D) Distal third of cymbium d surface with c. 16(18) long, acicular, inclined spines. RTA digitate, non-swollen; d surface covered with 47(60) short, pointed spines. Tibial excavation rv edge with a suspended brush of c. 32(35) long spines extending onto short horizontal DTA. TEM absent. Tibial excavation chitinized, TET not seen. — *Bulb*. (Fig. 12B,C) Length 1.41. Embolic rl flange edge slightly curved, revolute, entire; flange d surface smooth, without folds. Embolus narrow, tubular, almost straight, apophysis absent. — *Scopula*. Complete on tarsi I and II; sparse, complete on tarsi III and IV; metatarsi I and II incomplete; metatarsi III weak distal remnant; absent on metatarsi IV. — *Trichobothria*. Palp: tarsi 8, tibia pd 6, rd 6. Leg I: tarsi 10, metatarsi 12, tibia pd 6, rd 6. Leg II: tarsi 10, metatarsi 10, tibia pd 5, rd 6. Leg III: tarsi 10, metatarsi 8, tibia pd 6, rd 7. Leg IV: tarsi 11, metatarsi 11, tibia pd 8, rd 7. — *Leg spination*. (Fig. 12F–K) Leg I: metatarsi v 012; tibia v 0112. Leg II: metatarsi v 8 scattered; tibia v 6 scattered, pd 0110 (broken off). Leg III: tarsi pl 01000, rl 01010; metatarsi v 8 scattered, d 020220; tibia v 0122, pl 0110, rl 0110; patella pd 3. Leg IV: tarsi v 7 scattered; metatarsi v 9 scattered; pd 010 (broken off), rd 010010 (1 broken off); tibia v 5 (broken off) scattered, rd 01110 (broken off). — *Abdomen*. Dorsum with sparse cover long, erect, brown bristles with fine, underlying setae. Lateral surfaces and venter with dense cover of long fine hairs.

Taxonomic notes. Male specimen AMS KS65067 collected about 75 km south of the type locality appears to be morphologically identical to the holotype specimen with exception of the former lacking a venter pattern. Both specimens lack a tibial excavation mound and tibial excavation texture. Complementing this the male bulb lacks an apophysis and the retrolateral embolic flange edge is entire. The two specimens are taken to be conspecific with reservations.

Etymology. The species is named in recognition of Christine Horseman, one time technical officer and industrious collector of spiders in the arachnology section of the Australian Museum.

Distribution and natural history (Fig. 14B) Known only from the type locality near the township of Kioloa and c. 75 km S in the Dampier State Forest. The burrow is not known.

Misgolas elegans (Rainbow & Pulleine, 1918)

Arbanitis elegans Rainbow & Pulleine, (1918), pp. 12, 81–169, figs 12–24.
Dyarcyops elegans (Rainbow & Pulleine, 1918).–Main, 1977.
Misgolas elegans (Rainbow & Pulleine, 1918).–Main, 1985b.

The species *Arbanitis elegans* Rainbow & Pulleine, 1918 retained full species status (Main, 1977; Main, 1985b), the revised status being *Misgolas elegans*. With morphology based on a single female its identity is uncertain and is considered here as a nomen dubium. Its collection locality is "Kaianga", revised here to read Kianga, (36°11'46"S 150°07'49"E) near Narooma (Fig. 14A).

Misgolas montanus (Rainbow & Pulleine, 1918)

Arbanitis montanus Rainbow & Pulleine, 1918, pp. 12, 81–169, figs 12–24; Main, 1977, placed in synonymy with *Dyarcyops fuscipes* (Rainbow, 1914); Main, 1985a, *Dyarcyops fuscipes* placed in synonymy with *Misgolas rapax*.

The species status of *Arbanitis montanus* Rainbow & Pulleine, 1918 was revised and removed from synonymy with *M. rapax* by Wishart & Rowell (2008) on expressed grounds of differences in male palpal morphology. Wishart & Rowell, 2008 explicitly removed *M. montanus* from the synonymy of *M. rapax* but this was not accepted by Platnick (2010). To satisfy the minimal requirement the species is figured and diagnosed. Figures of the palp and bulb of *A. montanus* male syntype are provided here (Fig. 13A–C) to enable comparison with *M. rapax* (Fig. 4A–C). Differences in the number and size of folds along edge of retrolateral embolic flange and positions of apophysis on embolus is evidence of considerable weight demonstrating different species are being dealt with.

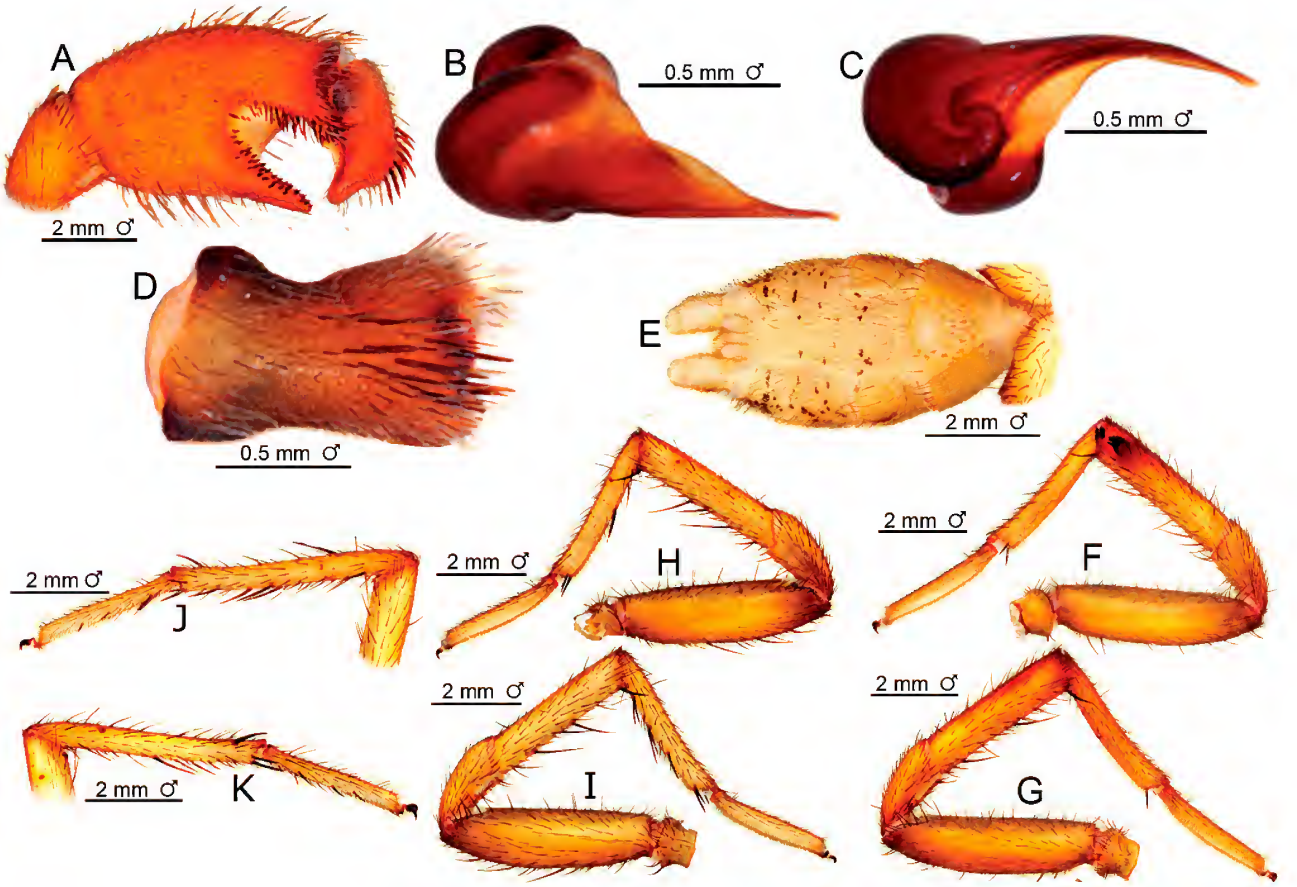

Fig. 12. *Misgolas horsemanae* n.sp. *(A–K)* ♂, holotype AMS KS2980: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral. *(D)* right cymbium dorsal. *(E)* venter. *(F,G)* right leg I: *(F)* prolateral, *(G)* retrolateral. *(H,I)* right leg II: *(H)* prolateral, *(I)* retrolateral. *(J,K)* right leg IV: *(J)* prolateral, *(K)* retrolateral.

Discussion

The tibial excavation mound (TEM) and texture (TET) are features introduced by Wishart (2006, figs 3H–I) at which time it was suggested to be a stridulatory accessory. An indication supporting this concept is demonstrated in this work where it is possible for the embolic flange, with its species variable corrugations, to be acting as a "plectrum" (Fig. 6F). In conjunction with Dr M.R. Gray some scanning electron microscope views have been examined. The results are not conclusive (the TET lines do not represent surface micro-corrugations and seem to lie just within the smooth cuticle surface) but indicate that the pattern of the texture may be different between species and consistent within species.

ACKNOWLEDGMENTS. My thanks to the Australian Museum for providing access to the collection and for the generous assistance of Mr Graham Milledge. I am grateful to Dr Helen Smith (Australian Museum) for providing the mapping and to Drs Smith & Robert Raven (Queensland Museum) for constant encouragement. The advisory roll of Dr Michael Gray, though retired, is unceasing.

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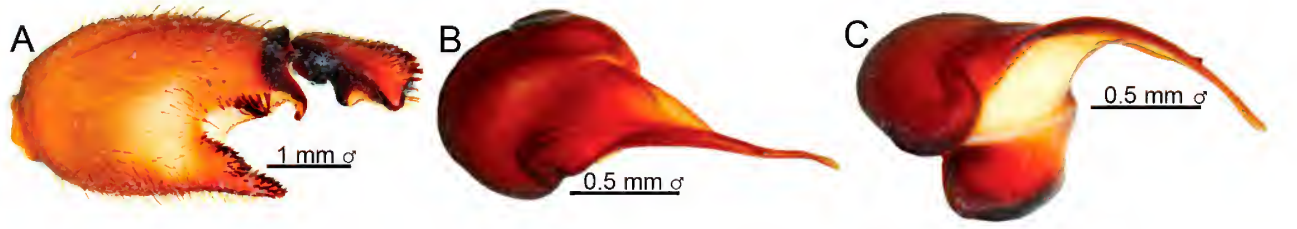

Fig. 13. *Arbanitis montanus* Rainbow & Pulleine. *(A–C)* ♂, syntype AMS KS6265: *(A)* right palp retrolateral. *(B,C)* right bulb: *(B)* dorsal, *(C)* prolateral.

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Through publisher error this figure (Figure 14) did not appear in the print version of this work published 29 June 2011. An erratum with this figure will be printed in the next issue of the *Records of the Australian Museum.*

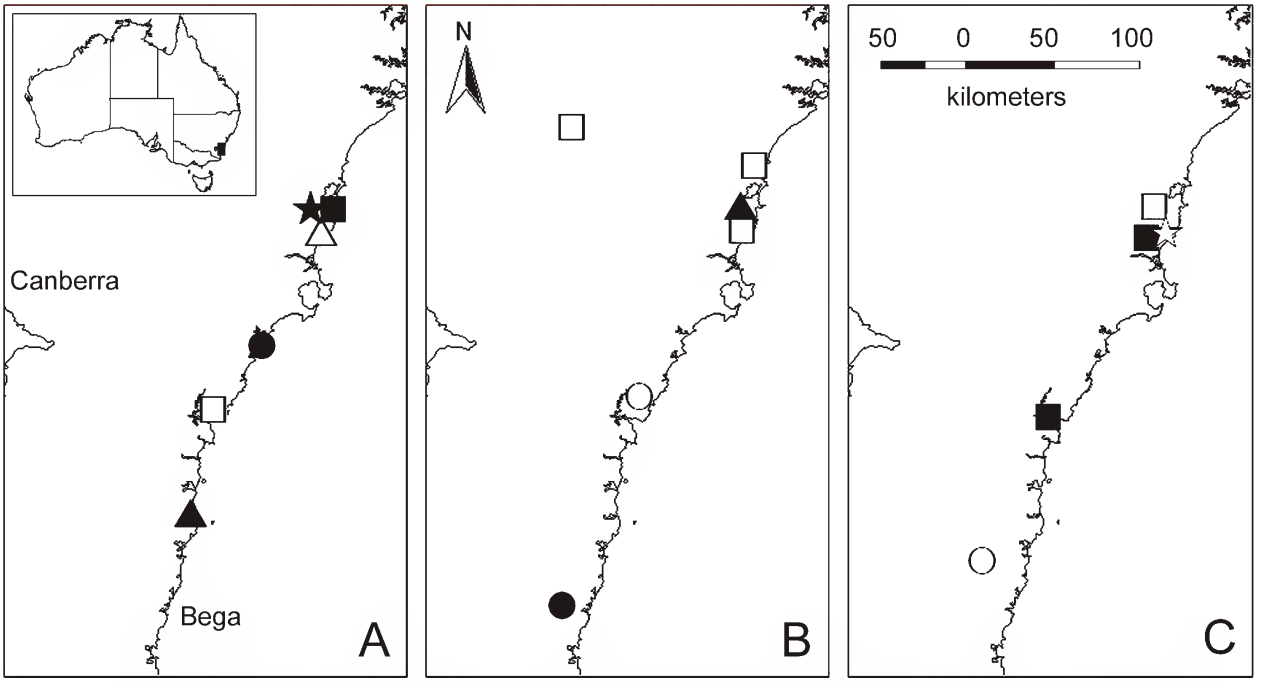

Fig. 14 A–C. Distribution of *Misgolas* species in the New South Wales Illawarra and South Coast (eastern Australia) based on material examined. (Inset [Fig. 14A] with catchment area). *(A)* ★ *M. gracilis*, ■ *M. rowelli*, △ *M. rapax*, ● *M. phippsi*, □ *M. kampenae*, ▲ *M. elegans. (B)* □ *M. dereki*, ▲ *M. robertsi*, ○ *M. horsemanae*, ● *M. shawi. (C)* □ *M. tannerae*, ■ *M. gwennethae*, ☆ *M. kirstiae*, ○ *M. paulaskewi*.

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New Frogs (Anura: Microhylidae) from the Mountains of Western Papua New Guinea

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ABSTRACT. I describe two new species of microhylid frogs from the mountains of the central cordillera of western Papua New Guinea. One of these is in the arboreal genus *Oreophryne*; the other is in the fossorial genus *Xenorhina*. The *Oreophryne* is one of the largest members of the genus and is characterized by a ligamentous connection of the procoracoid to the scapula, webbing between the toes, fifth toe equal in length to the third, and a relatively short leg, wide head, long and narrow snout, and small finger discs. The *Xenorhina* species is among the smallest species of the genus and is distinguished by having a single odontoid spike, discs with circum-marginal grooves on all toes but the first, inflated lores, and a relatively long leg, short and broad head and snout, and features of color pattern. The *Oreophryne* is known from two localities approximately 30 km apart, and the *Xenorhina* is known only from its type locality. Both occur in the high mountains of Western Province, Papua New Guinea.

KRAUS, FRED, 2011. New frogs (Anura: Microhylidae) from the mountains of western Papua New Guinea. *Records of the Australian Museum* 63(1): 53–60.

Frogs are a major component of vertebrate biodiversity in the Papuan region (New Guinea and associated islands plus the Solomon Islands), with >400 species described from the region to date. This represents almost 6% of global amphibian diversity in an area comprising approximately 0.5% of the world's land area. This diversity no doubt stems from the region's high degree of mountainous terrain and insularization, both of which promote isolation and speciation. Yet the Papuan region's amphibian diversity remains poorly surveyed and described. Ongoing surveys have identified scores of new species requiring description, and additional undescribed species from earlier collections reside in museums. Many of these are not easily diagnosed because they lack information on advertisement calls or color in life that frequently allow for ready distinction among close relatives. However, some species are sufficiently distinctive morphologically that they present no difficulty in being diagnosed from already-known species. I identified several such species while working in the herpetological collection of the Australian Museum, Sydney in 2006 and 2007. Some of these have subsequently been described (Richards, 2007; Richards *et al.*, 2007). I take this opportunity to describe two of the remaining species, both members of the family Microhylidae. Each is from the mountains of the central cordillera of Papua New Guinea.

Materials and methods

All measurements were made with digital calipers or an optical micrometer to the nearest 0.1 mm, with the exception that disc widths were measured to the nearest 0.01 mm. Measurements, terminology, and abbreviations follow Zweifel (1985) and Kraus and Allison (2005a, b): body length from snout–vent (SV); tibia length from heel to outer surface of flexed knee (TL or TL_{knee}); horizontal diameter of eye (EY); distance from anterior corner of eye to center of naris (EN); internarial distance, between centers of external nares (IN); distance from anterior corner of eye to tip of snout (SN); head width at widest point, typically at the level of the tympana (HW); head length, from tip of snout to posterior margin of tympanum (HL); horizontal tympanum diameter (TY); width of the third finger disc (3rdF); width of the

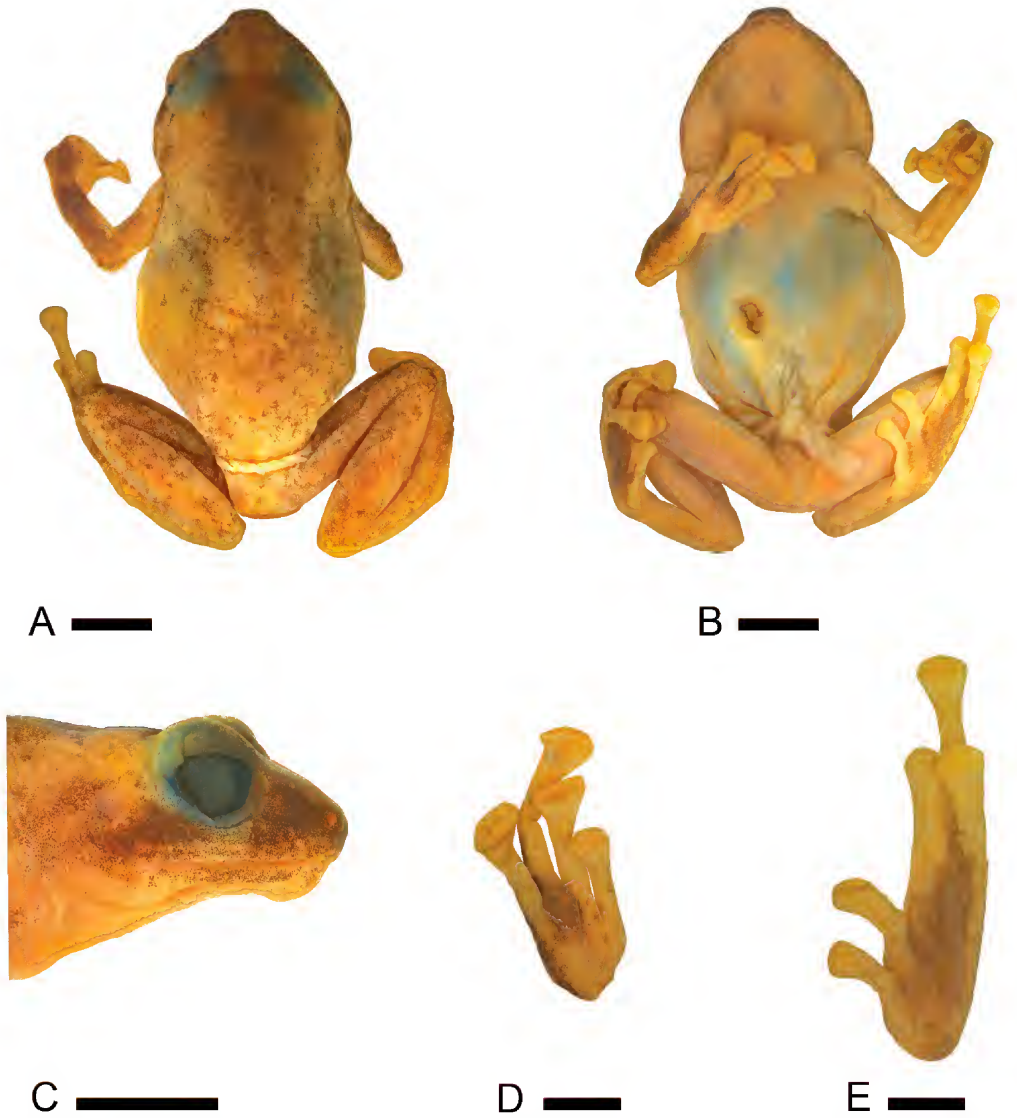

Fig. 1. Views of *(A)* dorsum, *(B)* ventrum, *(C)* side of head, *(D)* right hand, and *(E)* left foot of holotype (AMS 30742) of *Oreophryne ampelos*. Scale bars = 5 mm (A–C) and 3 mm (D–E).

fourth toe disc (4thT). For comparison to earlier literature for *Xenorhina* (Zweifel, 1972) I also measured tibia length from heel to skin fold near the knee (TL_{fold}) in that genus.

I confirmed by dissection generic assignment to *Oreophryne* using the presence of an eleutherognathine jaw and reduction of clavicles and procoracoids (Parker, 1934). Comparisons to congeners relied on direct comparison to museum material and to information provided in original descriptions by Roux (1910), Parker (1934), Richards & Iskandar (2000), Günther *et al.* (2001, 2009), Günther (2003a,b), Zweifel (2003), and Zweifel *et al.* (2003, 2005). I confirmed by dissection generic assignment to *Xenorhina* using the presence of an symphygnathine jaw and relatively small eyes and narrow head (Zweifel, 1972). Comparisons to congeners relied on direct comparison to museum material and to information provided in Zweifel (1972), Menzies & Tyler (1977), Blum & Menzies (1988), Allison & Kraus (2000), Kraus & Allison (2002, 2003), Günther & Richards (2005), and Günther & Knop (2006). Type specimens are deposited in the American Museum of Natural History, New York (AMNH), Australian Museum, Sydney (AMS) and the Bernice P. Bishop Museum, Honolulu (BPBM). Museum abbreviations for additional comparative material (Appendix) follow Leviton *et al.* (1985). Geo-spatial coordinates are derived from topographic maps.

Systematic descriptions

Oreophryne ampelos n. sp.

Figs. 1–2

Type material. Holotype female: Papua New Guinea, Western Province, Imigabip [5.2833°S 141.4833°E], 11 December 1969, collected by F. Parker, AMS 30742. Paratypes: same data as holotype, AMS 30741, BPBM 35949 (formerly AMS 30743), AMNH 84535–37; same data as holotype except collected 10 December, AMNH 84538–40; Finalbin [5.21°S 141.21°E], 27–28 July 1987, collected by R. Zweifel, F. Parker, and L. Penny, AMNH 130500.

Diagnosis. A large species of *Oreophryne* (adult male SV = 26.3–31.5 mm, adult female SV = 31.3–35.1 mm) distinguished by its combination of a ligamentous connection of the procoracoid to the scapula, webbing between the

Fig. 2. Portrait in life of paratype AMNH 130500 from Finalbin, Western Province. Photo taken by R. Zweifel.

toes, fifth toe subequal in length to the third or slightly longer, relatively short leg (TL/SV = 0.40–0.46), relatively long and narrow snout (EN/SV = 0.083–0.099, IN/SV = 0.074–0.092, EN/IN = 1.0–1.2), relatively wide head (HW/SV = 0.37–0.42), relatively small finger discs (3rdF/SV = 0.067–0.080), and dorsal pattern of brown punctations on a pale straw-yellow ground color which gives an overall appearance of a uniformly light tan, uniformly dark tan, or mottled light and dark tan animal (Figs. 1–2).

Comparisons with other species. The new species differs from all Papuan congeners except *Oreophryne albopunctata*, *O. biroi*, *O. furu*, *O. hypsiops*, *O. insulana*, *O. kapisa*, *O. mertoni*, and *O. unicolor* in the combination of having a ligamentous connection between the procoracoids and the scapula, in having the toes webbed, and having the third and fifth toes subequal in length. It is larger than each of these species, which never attain 30 mm SVL. In addition, *O. insulana*, *O. kapisa*, and *O. unicolor* have only basal webbing, whereas that in *O. ampelos* extends to the penultimate tubercle on the fifth toe and extends up to or slightly below that on the third toe; *O. albopunctata*, *O. hypsiops*, and *O. mertoni* have narrower heads (HW/SL = 0.30–0.37), whereas that of *O. ampelos* is wider (HW/SV = 0.37–0.42); *O. furu* has a whitish snout and postocular stripe and dark dorsolateral stripes and interocular bar, all of which are absent in *O. ampelos*, and it has a wider snout (IN/SV = 0.089–0.096, mean 0.093 in *O. furu* vs. IN/SV = 0.074–0.092, mean 0.081 in *O. ampelos*); and *O. biroi* has the top of the snout light colored and a pale postocular stripe, both lacking in *O. ampelos*.

Oreophryne ampelos differs from all other members of the genus except *O. anthonyi* and *O. idenburghensis* in its large size. It differs from *O. idenburghensis* in being smaller (SV = 43–47 mm in *O. idenburghensis*), having a ligamentous (vs. cartilaginous) connection between the procoracoid and scapula, the third and fifth toes subequal in length (T5>T3 in *O. idenburghensis*), more toe webbing, a wider head (HW/SV = 0.34–0.35 in *O. idenburghensis*), longer snout (EN/SV = 0.069–0.070 in *O. idenburghensis*), and smaller finger discs (3rdF/SV = 0.077–0.091 in *O. idenburghensis*). *Oreophryne anthonyi* is larger (SV = 30–47 mm) than *O. ampelos*, has the fifth toe longer than the third, a pair of)(-shaped folds between the scapulae (lacking in *O. ampelos*), and has a shorter and broader snout (EN/IN = 0.93–0.97 in *O. anthonyi*).

Description (holotype AMS 30742). Adult female with incision on right side. Head wide (HW/SV = 0.37), with steeply oblique, slightly concave loreal region. Canthus rostralis rounded, shallowly concave when viewed from above. Nostrils directed anterolaterally, closer to tip of snout than to eyes. Internarial distance narrower than distance from naris to eye (EN/SV = 0.83, IN/SV = 0.074, EN/IN = 1.12). Snout slightly rounded and protruding when viewed from the side, shallowly angulate when viewed from above. Eyes moderately large (EY/SV = 0.12); eyelid somewhat greater than half width of interorbital distance. Tympanum indistinct and small (TY/SV = 0.034). Dorsal skin smooth; ventral surfaces coarsely granular; supratympanic fold obscure, barely developed. Fingers unwebbed, bearing discs with terminal grooves (3rdF/SV = 0.067); relative lengths 3>4>2>1. Finger discs approximately twice width of penultimate phalanges. Subarticular tubercles well developed; inner metacarpal tubercle oval and well developed; outer absent. Toes webbed, webbing reaching penultimate tubercles on T2 and T5 and almost reaching penultimate tubercle on T3. Toes bearing discs with terminal grooves (4thT/SV = 0.058); relative lengths 4>5=3>2>1. Toe discs smaller than those of fingers (3rdF/4thT = 1.15),

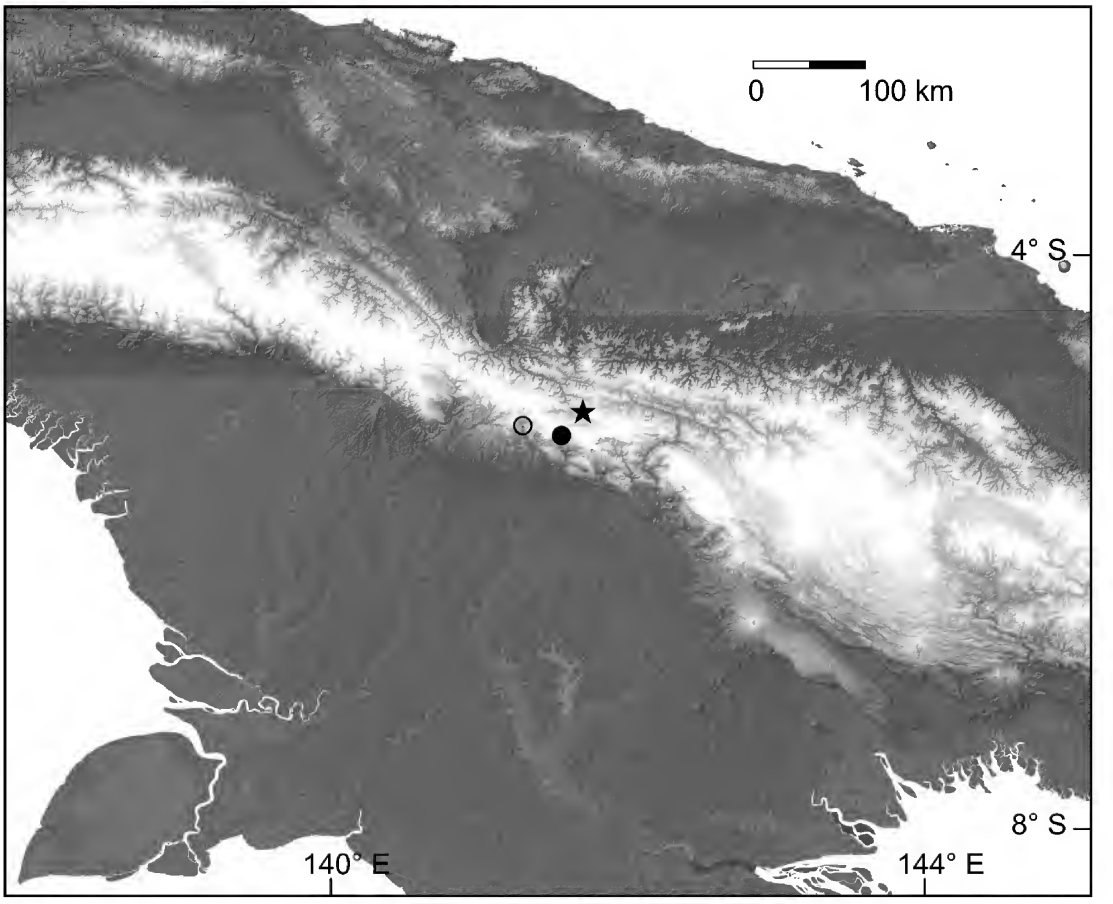

Fig. 3. Locality records for *Oreophryne ampelos* (● = type locality, ○ = other locality) and *Xenorhina brachyrhyncha* (★) in Western Province, Papua New Guinea.

approximately twice width of penultimate phalanges, except approximately 1.5 times width on T1. Subarticular tubercles distinct; inner metatarsal tubercle low and oval; outer absent. Hind legs rather short (TL/SV = 0.40).

In preservative, dorsum with pale straw-yellow ground color heavily stippled with minute brown punctations; stippling irregular in distribution, producing a mottled impression to the naked eye. Eyelids dark gray-brown; tympanum lighter than surrounding skin; face stippled more darkly than top of head or areas immediately behind. Rear of thighs as for dorsum. Venter pale straw yellow with brown punctations concentrated around lower jaw margin, and with sparse minute punctations scattered throughout chin and throat. Abdomen clear of punctations, and under legs virtually so. Iris black.

Measurements (in mm). SV = 35.1, TL = 14.0, HW = 13.1, HL = 10.6, IN = 2.6, EN = 2.9, SN = 4.5, EY = 4.1, TY = 1.2, 3rd F = 2.35, 4th T = 2.05.

Variation. Mensural variation for the few specimens of the type series is little (Table 1), and there appear to be no consistent difference between the sexes. The third and fifth toes are usually subequal in length, but a few specimens have the fifth toe slightly longer than the third. Toe webbing typically reaches up to the penultimate tubercle on the fifth toe but may either reach the bottom of the penultimate tubercle on the third toe or lie entirely below it.

Specimens vary in appearance from light tan to dark tan dorsally and are typically unicolor (Fig. 1), but may be mottled (Fig. 2); these differences reflect the degree to which minute dark-brown punctations, which produce the darker appearance, are distributed across the dorsum. Some specimens have stippling limited to the face and top of head; others have it evenly distributed across both dorsum and ventrum. One specimen (BPBM 35949) is very similar in coloration to the holotype but the dorsum is less mottled; the tympanum is not lighter and face not darker than the surrounding skin; and the chin, throat, and chest are more densely stippled with brown. AMNH 130500 too is heavily stippled laterally and dorsolaterally but has the top of head and mid-dorsum with little dark stippling, producing an appearance of a medium-brown frog mottled mid-dorsally with light tan. In life, this animal had a striking pattern of yellow tan and dark brown with pale blue-white flecks scattered across the dorsum and legs (Fig. 2). Two paratypes (AMS 30741 and AMNH 84537) have a wide light-tan vertebral stripe, margined on each side by a slightly narrower dark-brown stripe. In a few animals, the dark stippling is somewhat more concentrated along the canthus, giving the appearance of a vague darker line there. In life, AMNH 130500 had a tan iris with a few black veins (Fig. 2).

Mature males vary from 26.3–31.5 mm SV; mature females from 31.3–35.1 mm; BPBM 35949 is an immature female at 30.2 mm.

Etymology. The species is named, in allusion to its arboreal habits, for one of the hamadryads, demigods of Greek mythology who lived in trees. It is a proper noun in apposition, and the accent occurs on the first syllable.

Table 1. Mensural data for type series of *Oreophryne ampelos*. BPBM 35949 is immature; all others are mature.

character	AMS 30741 male	AMS 30742 female	BPBM 35949 female	AMNH 84535 female	AMNH 84536 female	AMNH 84537 female	AMNH 84538 female	AMNH 84539 male	AMNH 84540 female	AMNH 130500 male
SV (mm)	31.5	35.1	30.2	35.0	35.1	33.3	31.3	26.3	31.6	28.9
TL	13.4	14.0	12.5	15.4	15.0	13.8	14.2	12.0	14.0	12.2
EN	3.0	2.9	2.7	3.0	3.1	3.0	2.6	2.6	3.0	2.6
IN	2.5	2.6	2.5	2.8	2.7	2.6	2.4	2.3	2.9	2.4
SN	4.7	4.5	4.0	4.4	4.6	4.3	4.4	3.9	4.6	3.7
TY	1.2	1.2	1.1	1.4	1.4	1.6	1.3	1.2	1.5	1.2
EY	3.5	4.1	3.7	4.2	3.9	4.0	3.4	3.4	3.7	3.4
HW	12.2	13.1	11.2	12.9	13.6	12.5	11.9	11.0	12.2	10.7
HL	10.4	10.6	9.6	11.0	11.2	10.8	10.1	9.6	10.6	9.4
3rdF	2.15	2.35	2.30	2.56	2.70	2.30	2.38	2.05	2.54	1.99
4thT	1.75	2.05	1.95	1.96	2.36	1.68	1.96	1.49	2.04	1.76
TL/SV	0.43	0.40	0.41	0.44	0.43	0.41	0.45	0.46	0.44	0.42
EN/SV	0.095	0.083	0.089	0.086	0.088	0.090	0.083	0.099	0.095	0.090
IN/SV	0.079	0.074	0.083	0.080	0.077	0.078	0.077	0.087	0.092	0.083
SN/SV	0.15	0.13	0.13	0.13	0.13	0.13	0.14	0.15	0.15	0.13
TY/SV	0.038	0.034	0.036	0.040	0.040	0.048	0.042	0.046	0.047	0.042
EY/SV	0.11	0.12	0.12	0.12	0.11	0.12	0.11	0.13	0.12	0.12
HW/SV	0.39	0.37	0.37	0.37	0.39	0.38	0.38	0.42	0.39	0.37
HL/SV	0.33	0.30	0.32	0.31	0.32	0.32	0.32	0.37	0.34	0.33
3rdF/SV	0.068	0.067	0.076	0.073	0.077	0.069	0.076	0.078	0.080	0.069
4thT/SV	0.056	0.058	0.065	0.056	0.067	0.050	0.063	0.057	0.065	0.061
EN/IN	1.20	1.12	1.08	1.07	1.15	1.15	1.08	1.13	1.03	1.08
3rdF/4thT	1.23	1.15	1.18	1.31	1.14	1.37	1.21	1.38	1.25	1.13
HL/HW	0.85	0.81	0.86	0.85	0.82	0.86	0.85	0.87	0.87	0.88

Distribution. Known only from the type locality in the Hindenburg Range at 1280 m elevation of western Papua New Guinea (Fig. 3) and a second locality c. 30 km to the WNW in the Star Mountains at 840 m.

Xenorhina brachyrhyncha n. sp.

Fig. 4

Type material. Holotype female: Papua New Guinea, West Sepik Province, Telefomin [5.123° S, 141.637° E], 24 November 1956, collected by D. McMichael, AMS 15021. Paratype: same data as holotype except collected 26 November, BPBM 31889 (formerly AMS 15021).

Diagnosis. A small species of *Xenorhina* (adult female SV = 21.2–22.8 mm) with a single odontoid spike, slightly expanded discs with circum-marginal grooves on all toes except T1, inflated lores, relatively long legs (TL_{fold}/SV = 0.40–0.43, TL_{knee}/SV = 0.46–0.49), relatively short and broad head (HL/SV = 0.30–0.32, HW/SV = 0.35–0.38, HL/HW = 0.85–0.86), relatively short and broad snout (EN/IN = 1.06–1.13), abdomen straw with reticulation of brown flecks (Fig. 4), no dark loreal stripe, no dark supratympanic stripe, no white vertebral line, and rear of thighs brown with scattered straw flecks but with no white line or stripe.

Comparisons with other species. The single odontoid spike and very small size of the new species distinguish it from all congeners except *Xenorhina anorbis* and *X. lanthanites*. It is distinguished from *X. anorbis* by its longer legs (TL_{fold}/SV = 0.40–0.43 vs. 0.29–0.32 in *X. anorbis*), shorter snout (EN/IN = 1.06–1.13 vs. 1.26–1.32 in *X. anorbis*), presence on the toes of discs bearing terminal grooves (discs and grooves absent in *X. anorbis*), and abdomen straw with reticulum of dark flecks (uniformly light in *X. anorbis*). *X. brachyrhyncha* is distinguished from *X. lanthanites* in having an inflated (vs. concave) loreal region (Fig. 5), shorter and broader snout (EN/IN = 1.06–1.13 vs. 1.13–1.21 in *X. lanthanites*), slightly longer leg (TL_{knee}/SV = 0.46–0.49 vs. 0.42–0.46 in *X. lanthanites*), smaller and more obscure tympanum (TY/SV = 0.057 vs. 0.066–0.070 in *X. lanthanites*), larger foot (FootL/SV = 0.48–0.51 vs. 0.42–0.45 in *X. lanthanites*), absence (vs. presence) of a circum-marginal groove on first toe; absence (vs. presence) of a broad white dorsal stripe on the rear of the thigh, absence (vs. presence) of a dark loreal stripe, and absence (vs. presence) of a dark stripe curving above and behind the tympanum. Female *X. brachyrhyncha* are the same size as male *X. lanthanites*; hence, because females are the larger sex in most asterophryines, *X. brachyrhyncha* probably also differs in being of smaller body size than *X. lanthanites*.

Xenorhina brachyrhyncha is also similar to small specimens of *X. mehelyi* but is distinguished from that species by its smaller size (SV up to 37.0 mm in female *X. mehelyi*), shorter and broader snout (EN/IN = 1.06–1.13 vs. 1.29–1.61 in *X. mehelyi*), in lacking a circum-marginal groove on first toe (present in *X. mehelyi*), and lacking a white vertebral line and white line on the rear of each thigh.

Description of holotype. Adult female with right-lateral incision. Vomeropalatines each with a single enlarged odontoid spike. Head wide (HW/SV = 0.38), merging with body with no constriction at neck. Loreal region oblique, inflated; canthus rostralis absent; nostrils dorsoventrally compressed, directed anterolaterally, much closer to tip of snout than to eyes. Internarial distance much less than distance from naris to eye (EN/IN = 1.06, IN/SV = 0.075, EN/SV = 0.080). Snout inflated, slightly rounded when viewed from above, rounded when viewed from side. Eyes small (EY/SV = 0.075); eyelid less than half width of interorbital

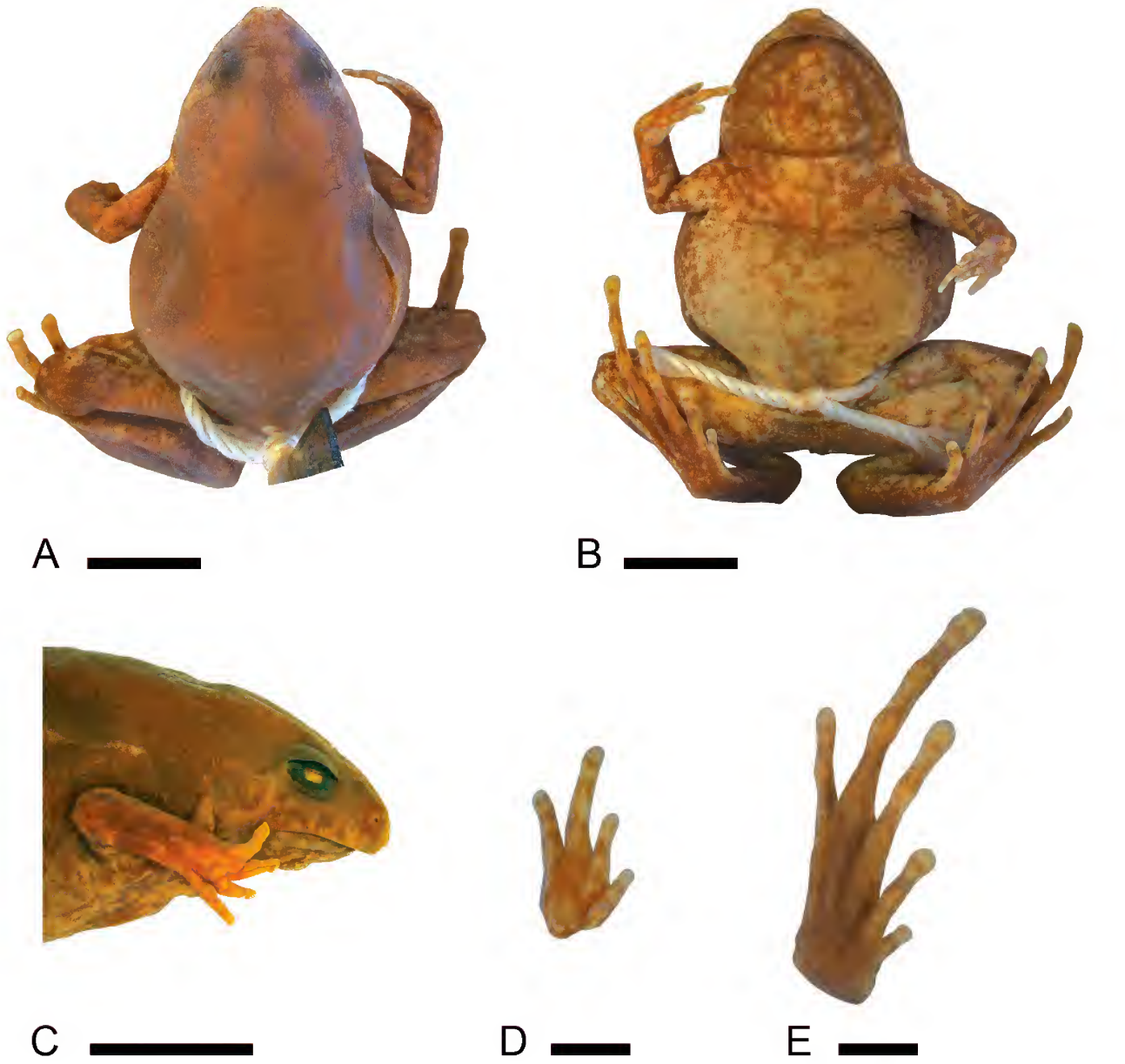

Fig. 4. *Xenorhina brachyrhyncha,* views of *(A)* dorsum, *(B)* ventrum, *(C)* side of head, *(D)* right hand, and *(E)* right foot of holotype (AMS 15021) of *X. brachyrhyncha*. Scale bars = 5 mm (A–C) and 2 mm (D–E).

distance. Tympanum very indistinct but large (TY/SV = 0.057). Dorsal, lateral, and ventral surfaces smooth; supratympanic fold slight. Fingers unwebbed, tips slightly flattened into discs on F2–F4 (3rdF/SV = 0.025), but only F3 with terminal groove; relative lengths 3>4>2>1. Finger discs barely wider than penultimate phalanges. Subarticular tubercles absent; inner metacarpal tubercle low and oval; outer low and rounded. Toes unwebbed, bearing discs with terminal grooves (4thT/SV = 0.039) except on T1; relative lengths 4>3>5>2>1. Toe discs larger than those of fingers (3rdF/4thT = 0.64), little wider than widths of penultimate phalanges. Neither subarticular tubercles nor metatarsal tubercles obvious. Hind legs rather short (TL_{knee}/SV = 0.49).

In preservative, dorsum uniformly medium brown; eyelids darker. Face and sides straw yellow heavily flecked with brown. Straw-yellow postocular stripe extending through tympanum, heavily flecked with brown and, hence, somewhat obscure. Rear of thigh straw-yellow heavily flecked with brown, imparting the general appearance of being brown with a few pale-straw markings. Venter pale straw yellow densely covered with brown flecks from chin through chest, more sparsely flecked on abdomen. Plantar and palmar surfaces brown. Iris brown.

Measurements (in mm). SV = 21.2, TL = 10.3, HW = 8.0, HL = 6.8, IN = 1.6, EN = 1.7, SN = 2.5, EY = 1.6, TY = 1.2, 3rd F = 0.53, 4th T = 0.83.

Variation. The sole paratype is a female with enlarging but still unyolked ova. It is similar to the holotype in color pattern, but has a few obscure pale-straw markings dorsally, has less brown flecking on the abdomen, and has a somewhat more distinct pale postocular stripe. Its measurements are: SV = 22.8, TL = 10.5, HW = 8.0, HL = 6.9, IN = 1.5, EN = 1.7, SN = 2.4, EY = 1.8, TY = 1.3, 3rd F = 0.56, 4th T = 0.80.

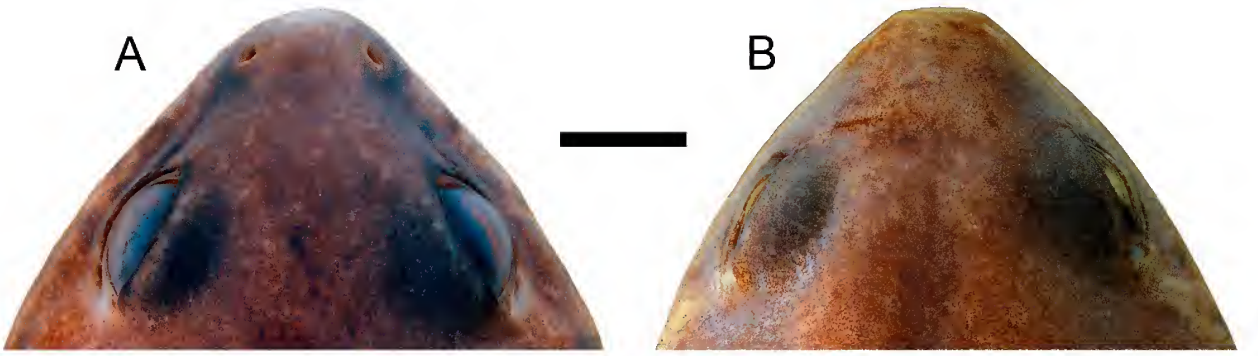

Fig. 5. Snouts of *(A) Xenorhina lanthanites* (ZMB 69557), and *(B) X. brachyrhyncha* (AMS 15021) showing difference in shape of loreal region. Scale bar = 2 mm.

Etymology. The species name is a latinized feminine combinatorial adjective derived from the Greek words "brachys", meaning "short" and "rhynchos", meaning "snout", in reference to the feature which distinguishes this species from its most similar congeners.

Range. Known only from the type locality at approximately 1500 m in the Star Mountains of western Papua New Guinea (Fig. 3).

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Appendix

Additional specimens examined

Oreophryne albopunctata: Indonesia: Papua Province: Lorentz River, near Sabang (ZMA 5821, syntype).

Oreophryne anthonyi: Papua New Guinea: Central Province: Mt. Victoria (BMNH 1947.2.12.38–39, syntypes).

Oreophryne anamiatoi: Papua New Guinea: Southern Highlands Province: Muller Range, E slope Mt. Itukua (BPBM 33768, holotype, 33763–67, 33769–79, PNGM 24097–100, paratypes).

Oreophryne biroi: Papua New Guinea: East Sepik Province: Hunstein Mts., E slope Mt. Hunstein (BPBM 23481–85); Madang Province: Adelbert Mts., Keki Lodge, 4° 42.291'S 145° 24.251'E, 854 m (BPBM 34689–92); West Sepik Province: Bewani Mts., Trefas Village (BPBM 14509–11), Torricelli Mts., S slope Mt. Sapau (BPBM 22786).

Oreophryne brachypus: Papua New Guinea: East New Britain Province: 2–12 km NNW Marmar (BPBM 22509–36).

Oreophryne crucifer: Indonesia: Papua Province: Went Mts. (ZMA 5819, syntype).

Oreophryne ezra: Papua New Guinea: Milne Bay Province: Sudest Island, Mt. Rio (BPBM 20468, holotype, 20467, 20469–95, PNGM 24086–92, paratypes).

Oreophryne flava: Indonesia: Papua Province: Kloofbivak, near Lorentz River (ZMA 5823, holotype).

Oreophryne geislerorum: Papua New Guinea: Morobe Province: Mindik (BPBM 5285–86); NW slope Mt. Shungol (BPBM 18510–12), Bowutu Mts., Kamiali Wildlife Management Area (BPBM 31473, 31877).

Oreophryne hypsiops: Papua New Guinea: East Sepik Province: Dreikiker (BPBM 1171, paratype), Wewak (BPBM 1179, paratype); Madang Province: near Sempi (AMNH 83043, 83045, paratypes), Wanuma, Adelbert Mts. (AMNH 83046–47, paratypes).

Oreophryne idenburgensis: Indonesia: Papua Province: Idenberg River, 18 km SW Bernhard Camp, 2150 m (AMNH 49663, holotype; AMNH 49666, paratype).

Oreophryne inornata: Papua New Guinea: Milne Bay Province: Goodenough Island, E slope Oya Madau (AMNH 57000, holotype, AMNH 56731, 56912, 56984, 57262, 57353, paratypes), Fergusson Island, E slope Oya Tabu (BPBM 16217–41, 16245), Fergusson Island, S slope Oya Waka (BPBM 16243, 1624956).

Oreophryne insulana: Papua New Guinea: Milne Bay Province: Goodenough Island, E slope Oya Madau (AMNH 57267, holotype, AMNH 56915, 57265–66, paratypes), Fergusson Island, E slope Oya Tabu (BPBM 16119, 16546–51).

Oreophryne kampeni: Papua New Guinea: Central Province: Moroka (BMNH 1947.2.12.14, holotype; BMNH 1947.2.12.43–44, paratypes).

Oreophryne loriae: Papua New Guinea: Central Province: Moroka (BMNH 1947.2.12.41–42, paralectotypes, BPBM 22537–39, UPNG 2184, 4155); Milne Bay Province: Alotau (UPNG 1683, 2611, 4934), Normanby Island (BPBM 16552–55).

Oreophryne notata: Papua New Guinea: Southern Highlands Province: E slope Mt. Itukua, Muller Range, 2170 m (BPBM 33672–706).

Oreophryne parkeri: Papua New Guinea: East Sepik Province, Hunstein Mts., E slope Mt. Hunstein (BPBM 23477–80); West Sepik Province: Torricelli Mts., S slope Mt. Sapau (BPBM 22781–85), Bewani Mts., Trefas Village (BPBM 23475–76).

Xenorhina adisca: Indonesia: Papua Province: Sudirman Mts., Tembagapura, 4.14009°S, 137.09782°E, 2200 m (MZB 8403, holotype, MZB 8404, BPBM 14915, paratypes).

Xenorhina anorbis: Papua New Guinea: Western Province: Finimterr, 2133 m, Star Mts. (UPNG 7261).

Xenorhina arboricola: Papua New Guinea: East Sepik Province: Hunstein Mts., 1.3 km S, 2.3 km E summit of Mt. Hunstein, 1000 m (BPBM 13745); West Sepik Province: Bewani Mts., S slopes of Mt. Menawa, 8.5 km N, 14 km E Utai aerodrome, 1200 m (BPBM 13746–47).

Xenorhina arfakiana: Indonesia: West Papua Province: Arfak Mts, between Makwam and Minyambou (UPNG 8203, holotype).

Xenorhina bidens: Papua New Guinea: Gulf Province: upper Turama River (UPNG 7464).

Xenorhina bouwensi: Indonesia: Papua Province: Star Mts., Sibil Valley, 1250 m (BPBM 1015), 3.2 km N Dasiga (BPBM 3686).

Xenorhina eiponis: Indonesia: Papua Province: Munggona, 1800 m (UPNG 7406, paratype).

Xenorhina fuscigula: Papua New Guinea: Madang Province: upper Kaironk Valley (UPNG 3242–43, paratypes); Western Highlands Province: Kaironk Valley near juction with Jimmi River, 1380 m (AMNH 83843–44), Tomba (MCZ 64805, 81672).

Xenorhina huon: Papua New Guinea: Morobe Province: mountains at head of Kua River Valley, 1630–2185 m (AMNH 76054, 76057–59, 76061, 76065, 76082, 76086, 76089), Indagen, N slope of Mt Kirin (AMNH 76099), Rawlinson Mts, upper Kua River Valley (UPNG 7426, 7428, paratypes).

Xenorhina lanthanites: Indonesia: Papua Province: Yapen Island, 17 km NE Serui, Amoman Mt., 1100 m (ZMB 69557, 69559–60, paratypes).

Xenorhina macrops: Indonesia: Papua Province: 3 km N Tempagapura (AA field series 15366–67, at BPBM), Tempagapura (AA field series 15494, at BPBM).

Xenorhina mehelyi: Papua New Guinea: Chimbu Province: Bomai, Tive Plateau (MCZ 53099); Gulf Province: Darai Plateau, 15.7 km N and 2 km E of Koumaio Landing Ground (BPBM 28177–82); National Capitol District: Omati, near Port Moresby (MCZ 28203–04); Southern Highlands Province: Namosado (AMS 122140, 122149, BPBM 35948); Western Province: Derongo (AMNH 82291, MCZ 81673), Imigabip (AMNH 84544, MCZ 80502, 81675), lower Kam Valley, Ok Tedi, 760 m (UPNG 7263).

Xenorhina minima: Indonesia: Papua Province: Serabum, 2400 m (UPNG 7409).

Xenorhina multisica: Indonesia: Papua Province: Jayawijaya Division: Munggona, Eipomek Valley (UPNG 7404, paratype).

Xenorhina ocellata: Indonesia: Papua Province: 9 km NE Lake Habbema (AMNH 43724), Bele River, 18 km N Lake Habbema (AMNH 43728, FMNH 121909); Fakfak District, Tembagapura, 2200 m (BPBM 14057–64), Hellwig Mts, 2500 m (FMNH 100100, syntype).

Xenorhina ophiodon: Indonesia: West Papua Province: Arfak Mts, between Makwam and Minyambou (UPNG 8210).

Xenorhina oxycephala: Papua New Guinea: East Sepik Province: 8.7 km N, 9.8 km E Mt. Hunstein, 75 m (BPBM 14269); West Sepik Province: 2 km W Utai aerodrome, 260 m (BPBM 13756–57).

Xenorhina parkerorum: Papua New Guinea: Chimbu Province: Nogar Village, Keowagi, 2200 m (UPNG 9358–59).

Xenorhina rostrata: Papua New Guinea: Madang Province: lower Kaironk Valley, 1300 m (UPNG 1926, neotype, 1063, 1920, 1922, 1924–25, 1929), Mt Gulno, 1044 m (UPNG 9264).

Xenorhina schiefenhoeveli: Indonesia: Papua Province: Munggona, Eipomek Valley, 1800 m (UPNG 7399, holotype, AMNH 128238, paratype).

Xenorhina subcrocea: Papua New Guinea: Morobe Province: 11 km N Lae (UPNG 4393, holotype, 4390, paratype).

Xenorhina tumulus: Papua New Guinea: Madang Province: Adelbert Mts, Mambimap, 1500 m (UPNG 7238, holotype); West Sepik Province: 2 km W of Utai Aerodrome, 210 m (BPBM 14065–66), Torricelli Mts., 3.2 km SSE Mt. Sapau summit (BPBM 22795).

Xenorhina zweifeli: Papua New Guinea: West Sepik Province: Bewani Mts., Mt. Menawa (BPBM 14052, holotype, BPBM 14047–51, 14054–56, paratypes).

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Australlus, a New Genus for *Gallinula disneyi* (Aves: Rallidae) and a Description of a New Species from Oligo-Miocene Deposits at Riversleigh, Northwestern Queensland, Australia

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ABSTRACT. *Gallinula disneyi* Boles, 2005, was based on Late Oligocene-Middle Miocene (c. 25–15 Ma) fossils from Riversleigh World Heritage Property in Boodjamulla (Lawn Hill) National Park, northwestern Queensland, Australia. If the generic assignment is correct, this species would be the earliest known crown group representative of Rallidae. We have therefore reassessed the phylogenetic relationships of this rail using both the original and newly recovered material. It is found to be a relatively basal rallid with some affinity to *Porphyrio*, and the new genus *Australlus* is erected for this taxon. A second species in the genus is described from Middle Miocene sites at Riversleigh World Heritage Property. A third rallid, smaller than either species of *Australlus*, is indicated by a mandible fragment, also from Riversleigh, but is not named. These rails are the only gruiforms known from Riversleigh and, with a single species of stork, are the only small non-passerine ground-birds known from these faunas.

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Rails (Rallidae: Gruiformes) comprise a cosmopolitan group, occurring on all continents except Antarctica. There are 140 or so living species, with another 500–1600 species hypothesized to have occurred on Pacific islands at the time of human contact (Steadman, 2006), whose extinction was mainly through anthropogenic causes. A significant number of living rails are flightless, as were the vast majority of recently extinct forms (e.g., Olson, 1977; Taylor, 1998; Steadman, 2006). Almost all non-volant species are, or were, restricted to small islands. Several Australasian taxa from larger landmasses were significant among flightless rails: the Weka *Gallirallus australis* (Sparrman, 1786) from both North and South islands of New Zealand, the takahe (*Porphyrio mantelli* (Owen, 1848) and *P. hochstetteri* (A.B. Meyer, 1883) from the North and South Islands of New Zealand, respectively) and the Tasmanian Native-hen *Gallinula (Tribonyx) mortierii* (DuBus, 1840) of Tasmania, also present on the eastern Australian continent into the Holocene (Baird, 1984; Worthy & Holdaway, 2002).

Within *Gallinula*, the extinct *G. hodgenorum* (Scarlett,

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1955) of New Zealand, well represented in late Pleistocene-Holocene fossil deposits, was also flightless (Olson, 1975). Two extant species, the Black-tailed Native-hen *G. (Tribonyx) ventralis* Gould, 1837, distributed through much of mainland Australia, and the Dusky Moorhen *G. (G.) tenebrosa* Gould, 1846, common in Australia, New Zealand and extralimitally of Australasia, are both volant. Other Recent flightless taxa of *Gallinula* are known from south Atlantic islands and Samoa (Olson, 1973a; Taylor, 1998).

The fossil form *Gallinula disneyi* Boles, 2005, is of interest because it was flightless and also occurred on the Australian mainland (Boles, 2005a). *Gallinula disneyi* was described from specimens recovered from the Riversleigh World Heritage Property in Boodjamulla (Lawn Hill) National Park, northwestern Queensland. The area has been intensively sampled for fossil vertebrates every year since 1975. Bird fossils are not uncommon in these assemblages (Boles, 1992; 1993a,b,c; 1995; 1997a,b; 2005a,b,c; 2006); however, to date the only gruiform taxon described is *G. disneyi*. Despite being a flightless form and the fact that many deposits are interpreted as pitfall traps, it is a comparatively rare species and, more surprising, other ground-dwelling gruids are entirely absent. This absence is even more notable given that ground-dwelling casuariids and dromornithids are relatively common in many sites (Boles, 1992; Archer *et al.*, 2006; Nguyen *et al.*, 2010). Since *G. disneyi* was described, other specimens and previously unknown elements have become available from Riversleigh faunas, which extend the skeletal representation for the species.

The generic assignment of *Gallinula disneyi* was made following comparisons of the fossil material with living taxa (Boles, 2005a) and no phylogenetic analysis was performed. Using the new fossils, together with the original material, a more detailed examination has been made here, and all available information has been incorporated into a phylogenetic analysis that allows several questions to be addressed.

Is the original generic placement of this species in *Gallinula* correct? Examination of original and new material suggests that it is not. As well as clarifying its phylogenetic position, resolving the generic placement of *Gallinula disneyi* allows reassessment of the suggestion that it might have been in the direct ancestry of the living flightless *Gallinula mortierii*.

The long temporal occurrence—Late Oligocene to Middle Miocene—of specimens originally assigned to *G. disneyi* is striking, thus inviting an assessment of whether more than one taxon is represented. That this might be so is indicated by the size variation among the original specimens, particularly the disparity between some femoral fragments. If more than one taxon is included in the hypodigm, how does this affect the temporal distributions of the respective species?

The evolutionary relationships of gruiforms have been the subject of investigation using genetic data in recent years (Houde *et al.*, 1997; Fain *et al.*, 2007). In the latter study, Fain *et al.* (2007) estimated the divergence times for several nodes in the phylogeny of gruiforms. In particular, they estimated the Heliornithidae–Rallidae divergence at 42.6 Ma (95% credible interval 65.5–27.1 Ma) and the base of Rallidae at 21.8 Ma (95% credible interval 35.6–12.9 Ma). The family Rallidae was represented by five taxa, with the following relationship: *(Porphyrio porphyrio + Laterallus melanophaius)* sister to *Rallus longirostris + (Porzana carolina + Fulica americana)*. Because *Gallinula* is normally considered most closely related to *Fulica* and *Porzana* (e.g., Livezey, 1998), the genus should have an origin relatively more recent than basal rallids. Thus, it is of considerable interest to note that *Gallinula disneyi* derives from Faunal Zone A and B sites at Riversleigh, which are Late Oligocene–Early Miocene in age, or about 25–23 Ma (Archer *et al.*, 2006). Its presence in deposits of this age is inconsistent with a 21.8 Ma divergence for basal Rallidae (Fain *et al.*, 2007). Mayr (2009) pointed out that if the assignment of *disneyi* to *Gallinula* was correct, then this species would be the earliest known crown group representative of the family, another reason that reassessment of the generic identification is desirable.

Livezey (1998) investigated gruiform relationships, sampling all genera, using a data matrix of 381 morphological characters (361 osteological, 12 of natal plumages, one of the glandula uropygialis and five of the definitive integument). His was a two level analysis, in which a first analysis resolved the relationships of all families and genera of basal rallids, but a second analysis, including an additional 189 integumental characters, was used to resolve the relationships of the large group of more derived rallids. Much of the poor resolution in the rallid phylogeny resulting from the first level revolved around taxa with missing data, flightless endemic island taxa, and many taxa of limited distributions far removed from the Australian evolutionary arena. Importantly, Livezey's (1998) preferred tree topology was concordant with the pattern of relationships found by Fain *et al.* (2007). Because Livezey's data matrix sampled all basal gruids, especially the near relatives of rallids, such as *Heliornis* and *Psophia*, and was relatively well resolved for basal rallids, it provided an independent, or objective, framework with which to assess the phylogenetic relationships of *Gallinula disneyi*.

Methods

We compared the fossil bones to gruiform specimens listed in the Comparative Material. Often, comparisons were made under magnification using a binocular microscope. Measurements (mm) were taken with Tesa dial calipers to the nearest 0.1 mm.

Anatomical nomenclature—Names for specific bone landmarks follow Baumel & Witmer (1993) and nomenclature for the hypotarsal canals follows Mayr (2004). Some common terms are abbreviated as follows: L, left; lig, ligamentum; M., musculus; proc., processus; tuber, tuberculum; Ma, million years ago; R, right. Anatomical landmarks are abbreviated in figure captions.

Taxonomic nomenclature—Nomenclature follows Christidis & Boles (2008) for Australian taxa, except that we place those species listed in *Tribonyx* at the subgeneric level in *Gallinula*, following Marchant & Higgins (1993); thus, our reference to *Gallinula* includes *Tribonyx* species. Where necessary, the latter taxa are distinguished as *Gallinula (Tribonyx)*.

Institutional abbreviations—*AM*, Australian Museum, Sydney, New South Wales, Australia; *ANWC*, Australian National Wildlife Collection, CSIRO, Canberra, Australia; *MV*, Museum Victoria, Melbourne, Victoria, Australia.

Comparative material

Rallidae: *Porphyrio porphyrio melanotus* AM A.612; *Amaurornis moluccana* AM O.59391, O.60030, O.60031, O.72349; *Gallinula (Gallinula) tenebrosa* AM O.60402, O.67057; *Gallinula (Tribonyx) ventralis* AM O.60910, O.71157, O.71392, O.72427; *Gallinula (Tribonyx) mortierii* AM O.64569; *Gallirallus philippensis* AM O.56994, O.59296, O.64202, O.70869, O.71174, O.72331, O.72342; *Gallirallus australis* AM O.53856; *Gallirallus (Tricholimnas) sylvestris* AM O.56432, O.58027, O.58028, O.64571; *Gallirallus lafresnayanus* AM B.6147; *Rallus limicola* AM O.66437; *Lewinia pectoralis* AM O.60489, O.64836; *Porzana fluminea* AM O.59879; *Porzana tabuensis* AM O.56985; *Poliolimnas cinereus* AM O.58011; *Fulica atra* AM S.558, O.57103; *Fulica americana* AM O.70191; *Coturnicops novaeboracensis* AM O.62352; Gruidae: *Anthropoides virgo* AM S.1215; Rhynochetidae: *Rhynochetus jubata* AM O.57000; Heliornithidae: *Heliornis fulica* MV B.13252.

Phylogenetic analysis

We examined the phylogenetic relationships of *Gallinula disneyi* by adding this taxon to the dataset compiled by Livezey (1998). We modified Livezey's dataset as follows. For Messelornithidae, the following character states were changed to follow Mayr (2004): character 1 to (b); 50 to (?); 176 to (a); 182 to (a), 184 to (b); 189 to (b), 201 to (a); 240 to (a); 250 to (?), 271 to (?). Character 189, the presence of a crista procoracoidei (b), *sensu* Livezey (1998) (i.e., a continuous crista linking the procoracoid to the crista medialis) is depicted by Hesse (1990: fig. 7). Also, following Mayr (2004), we altered character 240 to (a) for Rhynochetidae and character 184 to (b) for Eurypygidae. Despite these alterations, the placement of these taxa did not differ in our tree topologies compared to that obtained by Livezey.

We do not follow Mayr (2004) in considering the crista procoracoidei (char. 189) to be typically present in rallids such as *Gallirallus* and *Gallinula*, as we perceive a separation of the processus procoracoideus and crista medialis in such taxa, so they are left as (a). For character 208, we note that a distinct ventrally directed tubercle is present on the crista deltopectoralis in *Gallinula (Tribonyx) mortierii*, but not in *Gallinula (Tribonyx) ventralis*, so this character was changed to (01) in the matrix for *Tribonyx*. For *Gallinula* char 241, we recognize variation in the depth of fovea carpalis caudalis and code the genus deep to very deep (12). We coded *Gallinula disneyi* according to the definitions in Livezey (1998) and, where we found interpretation of the characters difficult, Livezey's scores for *Gallinula* and *Gallirallus* were examined and the state in *Gallinula disneyi* deduced relative to those taxa.

Following initial analyses with the complete taxon set, we further modified Livezey's (1998) data matrix by successively deleting taxa to seek a consensus tree with less conflict, i.e. fewer shortest trees, based on the following rationale. None of the taxa deleted resulted in any marked changes in tree topology. Because Livezey's (1998) analysis was aimed at determining the relationships of all gruiform taxa, many taxa he included were unnecessary for our purpose of determining the relationship of *Gallinula disneyi*. We deleted Phorusrhacoidea and *Heliopais*, because they are not closely related to an Australian rallid, and they were missing significant data. Further, we deleted several rallid taxa that were flightless island endemics related to *Gallirallus* (i.e., both *Aphanapteryx* species, *Nesotrochis, Diaphorapteryx, Capellirallus, Nesoclopeus, Atlantisia*). We also omitted some taxa that had much missing data and/or were very unlikely to be related closely to *Gallinula disneyi* because they were endemic to areas geographically distant from Australia (*Rougetius, Pardirallus, Cyanolimnas, Ortygonax, Rallus madagascarensis, Habropteryx, Micropygia, Coturnicops* and *Nesocrex*). We retained all species considered to have affinities with gallinules and a suite of Australasian *Gallirallus* relatives, including the flightless *Gallirallus (Tricholimnas) sylvestris, Gallirallus australis* and *Cabalus*. This ensured that we adequately examined a gallinule relationship for *Gallinula disneyi* and whether flightlessness created over-riding homoplasy. In summary, *Gallinula disneyi* was analysed with 50 remaining ingroup taxa and the seven outgroup charadriiform taxa used by Livezey (1998).

The character matrix (Appendix 2) was analysed with PAUP*4.0b10 (Swofford, 2001). Parsimony analyses used heuristic searches with tree-bisection-reconnection (TBR) branch swapping, and 1000 random addition replicates per search. Trees were rooted with outgroups forming a polytomy at the base of the tree. When calculating tree lengths, multistate taxa were treated as polymorphisms rather than ambiguity. Gaps were treated as missing data. Strict consensus trees were computed and are presented here. Bootstrapping (Felsenstein, 1985) used the same settings. Because of non resolution of parts of the Rallidae, a standard bootstrap analysis of 1000 heuristic searches each with 1000 replicates was impractical to achieve, so during the heuristic search the commands *nchuck* = 100 and *chuckscore* = 10 were used, so no more than 100 trees of score (length) greater than or equal to 10 was saved in each replicate. The analysis was aborted after 518 heuristic searches each with 1000 random addition replicates because of practical considerations of computer time (262 hrs) and the resulting values for the maximum likelihood tree used. Trees were manipulated and labelled in MrEnt (Zuccon & Zuccon, 2006).

Geology and geological setting

The Riversleigh World Heritage Propertry deposits are located 5 km west of the Riversleigh homestead (19°02'S 138°45'E), 200 km north of Mount Isa, northwestern Queensland, where they occur as an outcrop of Tertiary limestone overlying the Cambrian Thorntonia Limestone. Over 200 discrete sites are known, which have revealed more than 290 species level taxa (Archer *et al.*, 2006). The sites are all within fresh water limestone. In some sites, fossils were deposited during limestone deposition behind tufa barrage dams. A majority of sites are palaeocave deposits, where fossils were deposited in caves eroded in the primary limestone. These caves have long since been completely infilled, their sediments lithified, and their sediments are now exposed on the eroding limestone surface (Travouillon, 2008). All sites have been allocated a relative age based on species assemblages and relative evolutionary grade of taxa. Sites were originally categorized as Systems A, B and C, but are now referred to as Faunal Zones A to C (Archer *et al.*,

1997, 2006; Creaser, 1997; Travouillon *et al.*, 2006).

Faunal Zone A correlates with faunas from the Etadunna and Namba Formations in South Australia, dated by Woodburne *et al.* (1994) as latest Oligocene (26–24 Ma). Two Faunal Zone A sites have yielded fossils of rails. The greatest diversity of specimens comes from White Hunter Site, deposited in an open aquatic situation, the sediments of which are part of Hal's Hill Sequence of the D-Site Plateau. A range of avian taxa has been found at this site. A single specimen is known from LSO Site, of the Verdon Creek Sequence, in the northern section of the D-Site Plateau.

Sites in Faunal Zone B (Early Miocene) have produced rail fossils at five sites that were mostly former caves. Camel Sputum Site, of the Godthelp Hill Sequence, also on the D-Site Plateau, has produced several avian taxa. Dirk's Towers Site and Judith Horizontalis Site are in the Verdon Creek Sequence in the northern section of D-Site Plateau. Several elements have been recovered from the former site, a single specimen from the latter. Wayne's Wok Site and Creaser's Ramparts Site are in the Hals Hill section of D-Site Plateau. A single specimen has been recovered from each.

Faunal Zone C is considered to be Middle Miocene and approximately 15 Ma old. Four sites have produced fossil rails: three specimens from the palaeocave AL90 Site; two specimens from Ringtail Site, a tufa deposit; and one each from Jim's Jaw Site and Golden Steph Site, both palaeocave deposits. The age of Ringtail Site, of the Ray's Amphitheatre Sequence, Gag Plateau, is somewhat uncertain, as discussed at the end of this paper. Golden Steph Site is tentatively assigned to this faunal zone, but there are too few taxa for confident biocorrelation. Golden Steph and Jim's Jaw Sites are both in the northern end of Gag Plateau, and AL90 is from the southern section of Gag Plateau. The rails discussed here are thus known from 11 sites across all three faunal zones, and they occur in both palaeocave and open former fluvial/lacustrine-type sites.

Results

Fossils available from the Riversleigh Oligo-Miocene deposits now provide evidence for three gruiform taxa, of which one is *Gallinula disneyi*. A second is a larger taxon, represented by both new material and some originally included in *G. disneyi*, which is described below. A third species, smaller than the previous two mentioned, is represented by a single specimen from the Ringtail Site. None of the fossils featured articulated elements. With the exception of those from the Ringtail Site, elements of only one rallid species were found in any given site, so we adopted the parsimonious position that just two larger taxa are represented (see below), and we allocated specimens to species based initially on size. Below we introduce this new material, identified as "newly referred specimen" and augment previous descriptions of known elements with consideration of features used by Livezey (1998) in his morphology-based phylogenetic analysis of rallids and other gruiforms. We especially draw comparisons with *Gallinula tenebrosa, G. ventralis*, and *G. mortierii* to examine the relationship with *Gallinula* previously proposed by Boles (2005a), and then extend our observations more widely within the family Rallidae. A number of features differentiate these rails from any known rallid taxon, so a new genus is introduced for them.

Systematic palaeontology

Order Gruiformes (Bonaparte, 1854)

Family Rallidae Rafinesque, 1815

Genus *Australlus* new genus

Type species. *Gallinula disneyi* Boles, 2005.

Etymology. From *australis*, Latin, southern, and as it relates to Australia; and *rallus*, Latin, name of rails.

Diagnosis. Differs from other genera of the Rallidae by the following unique combination of characters. Humerus with 1), crus dorsale fossae very robust; 2), tuber. ventrale relatively robust and dorsoventrally wide, with an autapomorphic arrangement of the similar sized insertion scars for the three ligaments arranged in an equilateral triangle, with that for the lig. m. coracobrachialis caudalis largest, ovate and occupying the caudal tip of the tuberculum, the scar for lig. m. subscapularis on the dorsal facies distinctly cranial to that for the lig. m. coracobrachialis caudalis and the scar for the lig. m. subcoracoideus on the ventral facies level with, but slightly cranial to, the scar for lig. m. coracobrachialis caudalis and only slightly smaller; 3), tuber. supracondylare ventrale relatively small and not extending proximally as far as condylus dorsalis; 4) and proc. flexorius projecting greatly ventrally. Coracoid, 5), with a prominent crista procoracoidei extending from the proc. procoracoideus to close to the crista medialis. Tarsometatarsus, 6), elongate, about 1.5 times the femoral length; 7), with crista medialis hypotarsi elongate, extending more than half the length of the hypotarsus; and 8), enclosing two hypotarsal canals, one for the tendon for M. flexor digitorum longus (canal 1) and the more plantar one (canal 2) that carried the two tendons, M. flexor perforatus digiti II and M. flexor perforans et perforatus digiti II.

Stratigraphy and age. All specimens of *Australlus disneyi* derive from sites of Faunal Zone A and B, except QM F20799 from Ringtail Site, which is attributed to Faunal Zone C (Travouillon *et al.*, 2006), and therefore is presumed to be of Middle Miocene age. QM F20799 does not differ materially from the other specimens of *A. disneyi* and is of similar size (Boles, 2005a), so there is no reason to doubt its identity. However, its preservation is unlike the other two specimens from Ringtail and similar to specimens from White Hunter Site, so perhaps its site of origin is incorrectly recorded.

Australlus disneyi (Boles, 2005)

Gallinula disneyi Boles, 2005: 182.

Enhanced description

In the interval since Boles (2005a) described *Australlus disneyi*, more material has become available that enables a more comprehensive description of this taxon and facilitates comparison with other rallids.

Cranium (newly referred specimen QM F23806, Camel Sputum Site).

A partial cranium (Fig. 1) preserving in one fragment areas caudad of the interorbital zone with loss of the rostrum basisphenoidale and the frontoparietal areas on the left side, but relatively complete on the right side with just the loss of the tip of the proc. postorbitalis and tip of the proc. zygomaticus. Associated fragments include the right side of the nasofrontal hinge and the part of the os mesethmoidale that lies ventral to it (Fig. 1). Measurements: width at temporal fossae, 19.7 mm; cranial height, 20.4 mm; estimated squamosal width, 21.6 mm; foramen magnum width, 6.0 mm, height 5.8 mm.

This cranium is very similar to, though slightly larger than, that of *Gallinula tenebrosa*. It comes from the same locality as two of the paratypes for *Australlus disneyi*, and it is of expected size, given typical rallid proportions, for that species. The os lacrimale is unfused, and the os nasale fused with the os frontale dorsal to the lacrimal facet. The nasofrontal hinge has a flexible joint and the same structure as in *Gallinula*. The fonticuli orbitalocraniales are of a similar relatively small size located in the dorsal half of the orbits. The caudal orbital margins are drawn out farther than in *Gallinula*, with sharper, more compressed margins, which more broadly overhang the orbits. The fossa temporalis is as shallow as in *Gallinula* and the crista temporalis is minimally separated from the crista nuchalis transversus by 3 mm. While the proc. postorbitalis is mostly lost, its remaining base suggests that it was relatively small and, likewise, the proc. zygomaticus could only have been small. The crista nuchalis transversus is distinct from a point dorsal to the proc. paroccipitalis to dorsal to the foramen magnum, and there is slight inflation of the prominentia cerebellaris to form hollows either side of it. The recessus tympanicus is relatively longer than in *Gallinula*; the proc. paroccipitalis forms a prominent caudal wall strongly linked to the squamosal margin of the recess, enclosing a broad sulcus lateral to the fenestra vestibule, which forms the caudolateral buttress for the cotylae quadratica otici. This area is relatively smaller and much more fenestrated in *Gallinula* species. The basisphenoid structure does not differ significantly from the conformation seen in *Gallinula ventralis*, except that the anterior parts of the lamina parasphenoidalis are a little more inflated.

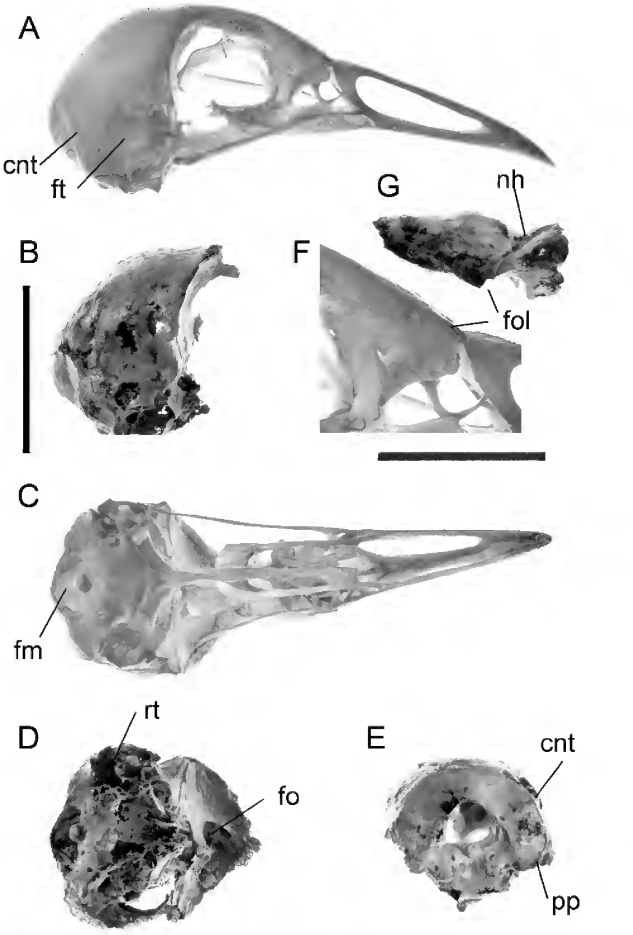

Fig. 1. Crania of *Gallinula tenebrosa* AM O.67057 *(A,C,F)* and *Australlus disneyi* QM F23806 *(B,D,E,G)* in right lateral *(A,B,F)*, ventral *(C,D)*, caudal *(E)*, and dorsolateral *(G)* views. Abbreviations: *cnt*, crista nuchalis transversus; *fo*, fonticuli orbitocranialis; *fol*, facet os lacrimale; *fm*, foramen magnum; *ft*, fossa temporalis; *nh*, nasofrontal hinge; *pp*, processus paroccipitalis; *rt*, recessus tympanicus. Scale bar for (A–E) is 20 mm and (F, G) is 5 mm.

Mandible (newly referred specimen QM F54503, White Hunter Site).

Most of the paratypic material for *A. disneyi* was recovered from White Hunter Site, so it is possible that this mandible derives from one of the same individuals. This specimen is a single mandible missing its tip (Fig. 2). During preparation, the os dentale fragments were disassociated from the more posterior parts of the mandible, which are preserved in their original depositional relationship to each other by a bridge that remains from the resin used to join fragments of the specimen together when it was in limestone. Measurements (mm): greatest width across the cotyla lateralis, 22.0; width between the tip of the proc. mandibulae medialis and proc. retroarticularis, 7.6; maximum depth, left side of the mandible, 6.5.

The overall form and proportions of the mandible are similar to those of *Gallinula tenebrosa* and it has a similar ventral depression of the anterior two-thirds of the os dentale. The fenestra caudalis mandibulae is small, but it is located relatively rostrally compared to all rallids examined, such that the distance to the cotyla lateralis exceeds the length of the cotyla lateralis; in other rallids, the cotyla lateralis is longer. The proc. mandibulae medialis houses a foramen pneumaticum dorsally near the tip, and it is larger and relatively more robust toward its tip than that of *G. tenebrosa*. The cotyla medialis is larger and protrudes over the medial profile in dorsal view to make a distinct angular prominence, much more so than in species of *Gallinula*. The cotyla medialis also extends farther laterad, such that it extends past the base of the surangular and is wider than the cotyla lateralis, whereas it and the cotyla lateralis have approximately similar widths in *Gallinula* species, with the base of the surangular at their junction. The proc. retroarticularis is more robust, but shorter, unlike the thin blade-like structure in *Gallinula* species. The dorsal margin of the crista transversus fossa is nearly flat with only a very shallow notch at mid-width, whereas it is more deeply notched in all compared rallids. A further significant difference from *Gallinula* species is seen in the profile of the lateral facies ventral to the cotyla lateralis: in QM F54503,

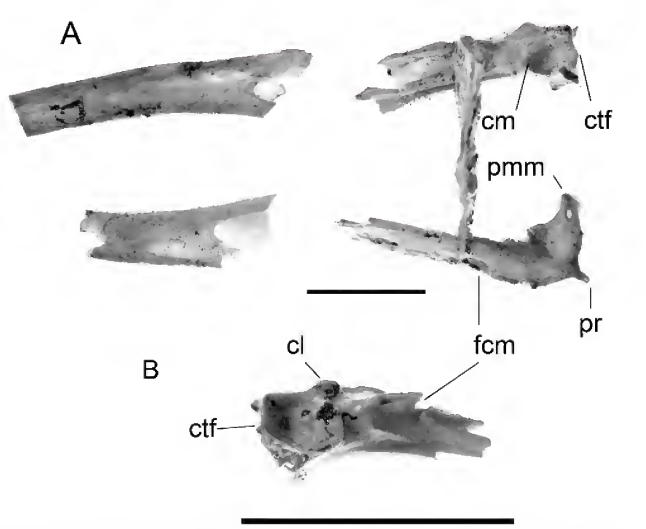

Fig. 2. Mandible fragments of *Australlus disneyi* QM F54503 *(A)* and rallid species QM F54524 *(B)*. The rami of QM F54503 are held together as fossilized by a resin bridge, but the os dentales have separated and so are shown medial facies up. Abbreviations: *cl*, cotyla lateralis; *cm*, cotyla medialis; *ctf*, crista transversus fossae; *fcm*, fenestra caudalis mandibulae; *pmm*, processus mandibulae medialis; *pr*, processus retroarticularis. Scale bars = 10 mm.

it is concave below the lip of the cotyla, whereas in species of *Gallinula*, it is convex.

Premaxilla (newly referred specimens: QM F30864, Wayne's Wok Site; QM F54505, Camel Sputum Site).

These premaxillae are both deeply vaulted ventrally between sharp tomial edges. Laterally, they have several vascular foramina; and the tips over their last 5 mm are slightly depressed relative to the more posterior tomial margin. These fossils are thus rather similar to the premaxilla of *Gallinula tenebrosa*. The referred cranium of *G. disneyi* was found in the samples from Camel Sputum Site. Measurements (mm) taken at anterior side of nasal aperture: QM F30864, length to tip, 11.3; width, 4.8; height, 4.2; QM F54505, length to tip, 11.5; width, 4.6; height, 4.7.

Vertebrae (newly referred specimens: QM F54506, cervical vertebra number 15 [where number 1 is the atlas vertebra], White Hunter Site; QM F54504, cervical vertebra number 12, White Hunter Site; QM F54507, cervical vertebrae number 11, White Hunter Site; QM F54508, cervical vertebrae number 14, White Hunter Site; QM F54515, cranialmost 4 fused vertebrae of synsacrum, White Hunter Site; QM F54509, cervical vertebra number 10, Dirk's Towers Site; QM F54510, anterior part synsacrum, Dirk's Towers Site). These vertebrae were compared with, and are very similar to, those of *Gallinula tenebrosa* (Tables 1, 2), *G. ventralis* and *Gallirallus philippensis*, and they were easily assigned to position. All came from sites where long bones of *A. disneyi* were also recovered, so they are referred to that species.

Humerus (QM F20906, proximal R, holotype, White Hunter Site, QM F31471, proximal R; QM F31472, distal L; newly referred proximal and shaft L, QM F45457 White Hunter Site).

In addition to the features described by Boles (2005a) for these specimens, we note the following:

1. The tuber. ventrale in *A. disneyi* is relatively robust and dorsoventrally wide compared to the condition in all rallids examined, in which it is typically dorsoventrally compressed and caudocranially elongated. Associated with this robust tuberculum is an autapomorphic arrangement of the insertion scars for the three ligaments inserting thereon. Typically in rallids, a large ovate scar for the insertion of M. coracobrachialis caudalis occupies the caudal tip of the tuberculum, with an elongate scar for lig. m. subscapularis positioned distinctly cranial to it on the facies bounding the incisura capitis, with a smaller ovate scar for the M. subcoracoideus adjacent to this but on the ventral facies of the tuberculum (following the terminology of Ashley, 1941). In *A. disneyi*, the holotypic specimen QM F20906 has damage to the cranial part of the tuber. ventrale and QM F31471 is more damaged, but QM F20906 reveals that the scar for the M. subcoracoideus is centred slightly farther caudocranially, but is essentially beside that for the M. coracobrachialis caudalis and is of similar size, rather than being entirely and distinctly cranial to it and smaller. This arrangement of ligament scars was not found in any Recent gruiform examined, but it is seen in the new species described below.
2. The caudal facies of the shaft distal to the crus dorsale fossae is angular.
3. The crus dorsale fossae is more robust than in species of *Gallinula* and *Amaurornis*.
4. The tuber. dorsale is relatively small, but prominent.
5. The crista bicipitalis is relatively small in *A. disneyi* with its distal junction with the shaft positioned slightly distal to the distal end of the crus dorsale fossae, resulting in its largely being occluded in caudal view.
6. The fossa pneumotricipitalis is shallow, and it is not penetrated by any pneumatic foramina.
7. The sulcus lig. transversus is much shallower in *A. disneyi* than in species of *Gallinula*, including *G. (Tribonyx) mortierii, Amaurornis* and most *Gallirallus* species, and is separated from the incisura capitis by a caudocranially thicker ridge. A similar condition is seen in *Gallirallus australis*.
8. The ventral side of the crista deltopectoralis has a distinct tubercle, which is variably present in *Gallinula*. A tubercle is present in *Gallinula (Tribonyx) mortierii* but not in *G. (Tribonyx) ventralis*. A tubercle is not present in the flightless and more modified members of the *Gallirallus* clade, such as *Gallirallus australis* and *Gallirallis sylvestris*, so its presence is not contingent on flightlessness.
9. The angulus cristata of the crista deltopectoralis is located distal to the crista bicipitalis and the part of the crista deltopectoralis distal to the angulus is less than the length proximad of the angulus. In contrast, the angulus lies proximal to the junction of the crista bicipitalis and the shaft, and the distal part of the crista deltopectoralis (i.e., that past the angulus) is longer than the proximal section in *Gallinula* and *Gallirallus*, including in the flightless taxa compared.
10. The crista deltopectoralis terminates distally on the cranial facies as opposed to on the dorsocranial margin as in most *Gallinula* and *Gallirallus* species. In flightless taxa, it is located more ventrally.

11. The crista deltopectoralis is markedly concave caudodorsally, rather than flat to convex.
12. The tuber. supracondylare ventrale is relatively small, not extending proximad so far as to be level with proximal margin of the condylus dorsalis, is wider than high, is relatively close to the condylus ventralis, and has the dorsal part of the articular facet angled dorsodistally, forming a wide angle with the ventral part of the facet. In *A. disneyi*, the fossa m. brachialis undercuts the tuberculum. In species of *Gallinula* and *Amaurornis*, the tuber. supracondylare ventrale is about as wide as long, has a similar proximal extent as the condylus dorsalis, has the dorsal part of the facet angled dorsodistally, and is distinctly separated from the condylus ventralis. In some *Gallirallus* species, such as *G. philippensis*, the tuber. supracondylare ventrale is narrower ventrodorsally, with its dorsal side directed significantly dorsally, so that it is nearly at right angles to the ventral side of the tuberculum. In the flightless *G. australis*, however, the tuberculum is wide and short and relatively small, so its reduced size in the Riversleigh fossil taxa could be related to flightlessness.
13. The proc. flexorius has relatively greater ventral projection than in *Gallinula* species, and is more robust. Viewed in cranial aspect, with both the proc. flexorius and condylus dorsalis lying on a planar surface, the dorsoventral width of the proc. flexorius exceeds half the dorsoventral width of the condylus ventralis (much thinner in *Gallinula*). The proc. flexorius extends slightly farther distad than the condylus ventralis in *A. disneyi*, as it does in *Gallinula* species.
14. The relative overlap medially of the condylus ventralis by the condylus dorsalis on its proximal side (in cranial view), used by Brodkorb (1967) to distinguish *Gallinula* from *Fulica* and discussed by Boles (2005a), was reassessed. When taxa were compared in the same orientation, where both the proc. flexorius and condylus dorsalis lay on a planar surface, we found no overlap of the condyles in *Heliornis* and *Porphyrio* species, but in all *Gallinula* species, *Amaurornis* species, *Gallirallus* species, *Rallus limicola, Fulica atra* and *F. americana*, the condyli overlapped on a plane parallel to the axis of the bone. In the material of *Australlus disneyi*, ventrodorsal overlap of the condyles is apparent.

Ulna (QM F30693, pL, Dirk's Towers).

There is no evidence for a second rallid in Faunal Zone A and B sites, with only Ringtail Site (Faunal Zone ?C) containing evidence of multiple species, including one fossil of a much smaller species than those described herein. There is no reason to doubt the referral of this ulna to *A. disneyi*, based on its appropriate size. The impressio brachialis in *A. disneyi* has a prominent crista brachialis (*sensu* Livezey, 1998: char 224), unlike in *Gallinula*. Otherwise, the ulna is little different from that of rallids.

Carpometacarpus (QM F30908, L, Dirk's Towers Site; QM F31478, L, Camel Sputum Site).

The labrum dorsalis (*sensu* Livezey, 1998, char 237) is relatively elongate, extending adjacent to the fovea carpalis caudalis, which is deep. In *Gallinula* species, the dorsal rim typically ends proximad of the fovea, as in *G. ventralis* and *G. tenebrosa*. The sulcus trochlearis is shallow and rounded. Otherwise, the differences between *A. disneyi* and *Gallinula* species are related to shortening of the element associated with loss of flight.

Coracoid (QM F30692, cranial part R, Dirk's Towers; QM F31469, cranial part L, White Hunter Site; QM F31470, cranial part R, White Hunter Site; QM F31477, sternal part and shaft L, Camel Sputum. Newly referred specimens: QM F39864, cranial part L, Judith's Horizontalis Site; QM F54513, cranial part and shaft L, White Hunter Site).

In addition to the features cited by Boles (2005a), we note the following in *A. disneyi*:

1 The foramen nervi supracoracoidei is large in *A. disneyi*, and it has large foramina penetrating the corpus, as in *G. (Tribonyx) mortierii*, but it is unlike that of *G. (Tribonyx) ventralis* and *G. tenebrosa*, in which the foramina opening into the corpus are very small (Fig. 3).
2 The coracoid of *A. disneyi* is characterized by a prominent, sharp crista procoracoidei (Livezey, 1998: char. 189), which extends from the proc. procoracoideus to a point close to the crista medialis, as in *Psophia* (Olson, 1973b: fig 2). The interpretation that the proc. procoracoideus extends about half way along the shaft, joining it gradually (Boles, 2005a) might have been inferred from broken specimen QM F31470. Specimen QM F31477 shows this to be incorrect. In this fragment, the proc. procoracoideus preserves its cranial margin and, although the crista is broken lateral to the foramen nervi supracoracoidei, it is clearly preserved sternal to this point. The crista procoracoidei is elongate, broad, dorsoventrally-thin, and it extends at least half the length of the impressio sternocoracoidei. Above the angulus medialis, the crista medialis is broken in QM F31477, so its connection to, or separation from, the crista procoracoidei is unknown. However, the preserved cristae are very similar to the state in *Porphyrio* and also to that seen in the coracoid attributed to the new species described below, in which the crista

Table 1. Vertebral measurements (mm) of *Gallinula tenebrosa* AM O.60402. Length is measured along midline of centrum, width is for the facies articularis caudalis. Vert # is the position in the vertebral series where the atlas is 1.

Vert #	3	4	5	6	7	8	9	10	11	12
Length	9.9	10.0	—	12.4	12.1	11.9	11.2	10.7	10.0	9.5
Width	2.0	2.2	—	3.0	3.3	3.2	3.6	3.6	3.8	4.6
Vert #	13	14	15	16	17	18	19	20	21	22
Length	8.2	6.8	6.2	6.9	8.1	8.4	8.3	8.4	8.2	8.1
Width	5.4	5.7	5.9	4.9	4.3	4.2	4.1	4.0	4.2	4.5

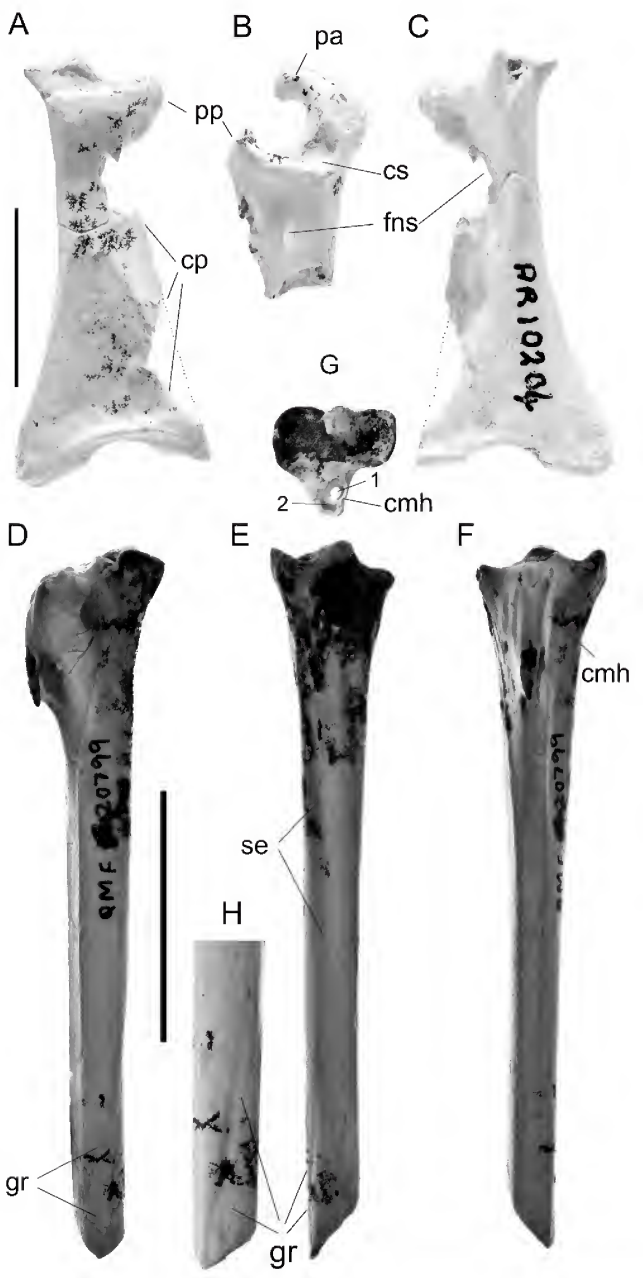

Fig. 3. Coracoids *(A–C)* of *Australlus disneyi*, left QM F31477 in dorsal *(A)* and ventral *(C)*, cranial part right QM F31470 in dorsal *(B)* views; scale bar = 10 mm. The crista medialis leading from the angulus medialis to the crista procoracoidei is broken in this specimen, as indicated by the dotted lines. Left proximal and part shaft tarsometatarsus of *Australlus disneyi* QM F20799 in medial *(D)*, anterior *(E)*, plantar *(F)*, proximal *(G)* views (scale bar = 20 mm), and medial view enlarged *(H)*. Abbreviations: *cmh*, crista medialis hypotarsi; *cp*, crista procoracoidei; *cs*, cotyla scapularis; *gr*, groove for extensor hallicus longus; *fns*, foramen nervi supracoracoidei; *pa*, processus acrocoracoideus; *pp*, processus procoracoideus; *se*, sulcus extensorius; *1*, tendinal canal 1 for M. flexor digitorum longus; *2*, tendinal canal 2 for M. flexor perforates digiti II & M. flexor perforans et perforatus digiti II.

procoracoidei extends close to, but does not connect to, the crista medialis (Fig. 3). Mayr (2004) considered the crista procoracoidei to be present in rallids, heliornithids, and messelornithids, and to support the monophyly of these taxa. We follow Livezey's definition and do not consider that the more derived rallids have a crista procoracoidei because in these birds the proc. procoracoideus merges into the shaft closer to the cranial end, and it is always separated by a broad distinct gap from the enlarged crista medialis, which extends from the angulus medialis. In *Heliornis*, there is a distinct crista connecting the proc. procoracoideus and angulus medialis, as recorded by Livezey (1998), although it is not as produced from the shaft as it is in *Psophia*.

3 The proc. acrocoracoideus overhangs the shaft ventrally somewhat more than in all *Gallinula* species, but it is more notable for the extreme rotation mediad over the sulcus m. supracoracoidei, such that its cranial margin is at a near right angle to the facies articularis humeralis.

4 The impressio lig. acrocoracohumeralis forms a shallow sulcus extending from the facies artic. humeralis to the tip of the proc. acrocoracoideus. This hollow is bisected by a laterodorsal—medioventrally aligned groove.

5 The ventral facies of the shaft is quite compressed in its cranial half (not broadly convex) making the adjacent lateral facies flattened and the resultant ridge is directed somewhat laterad, especially near the facies artic. humeralis. This causes the proc. acrocoracoideus to greatly overhang the ventromedial facies at an angle approaching 45 degrees to the sagittal plane. In all *Gallinula* species, the plane of the surface in the sulcus supracoracoideus and adjacent to the facies artic. clavicularis is essentially aligned dorsoventrally.

6 The proc. procoracoideus extends craniad beyond the cotyla scapularis.

Femur (QM F36452, pL, LSO Site).

The femur of *Australlus disneyi* is only represented by the relatively uninformative proximal fragment QM F36452. The preserved length of 39.8 mm extends just distal to the nutrient foramen, and its proximal width of 10.0 mm is similar in size and proportions to the femur of *G. ventralis* AM O.71392. Given similar total proportions, estimated total length for the fossil femur is about 54 mm. It is generally similar to those of *G. ventralis* and *G. tenebrosa*, with the most significant difference being that the insertion for the M. obturator externus is larger, causing a prominence on the caudal margin just distal to the facies articularis antitrochanterica, when viewed laterally, which is absent in extant *Gallinula* species.

Tibiotarsus (QM F31473, proximal R, White Hunter Site; QM F31474, distal R, White Hunter Site; QM F31475, distal R, White Hunter Site; QM F24130, proximal L, Camel Sputum Site; QM F31480, proximal R, Dirk's Towers Site; newly referred specimen QM F30696, distal+shaft L, Camel Sputum Site).

In addition to the points described by Boles (2005a), we note the following for *A. disneyi*. The sulcus extensorius grades into a distinct flat groove, which extends farther proximad than in *Gallinula* species. Specimen QM F30696,

which we refer to *Australlus disneyi*, is instructive as it has a preserved length of 77.6 mm for a midshaft width of 4.9 mm and distal width of 9.2 mm, but the proximal and distal ends of the fibular synostosis are 70 mm and 44.5 mm from distal end, respectively. In contrast, a tibiotarsus of *G. tenebrosa* (AM O.60402) has the comparable values: midshaft width 4.9 mm, distal width 8.9 mm, and the fibular synostosis extends from 54.5 to 42.5 mm from the distal end. Both observations indicate a tibiotarsus proportionally longer than any *Gallinula* species.

QM F30696 was identified by Boles (2005a) as the tibiotarsus of a rail, but because of its more robust nature and morphological differences, it was not placed with *A. disneyi* and left unnamed. It is considered here to fall within the range of variation of that species, and it is included with it.

We take this opportunity to correct a misidentification in Boles (2005a). A distal tibiotarsal fragment (QM F24605) from the Pleistocene Floraville Local Fauna (Site 5c, Floraville Stn, Leichhardt River, North Queensland) was incorrectly regarded as *Gallinula mortierii*. It is here recognized as Anatidae, ?Dendrocygnine. As this record would have been the most northwestern one for *G. mortierii*, its reidentification considerably reduces the known mainland distribution of that species.

Tarsometatarsus (QM F20799, proximal L, Ringtail Site; QM F23723, proximal R, White Hunter Site; QM F30720, proximal R, Creaser's Ramparts Site; QM F31476, distal R fragment lacking trochlea metatarsi II., White Hunter Site)

In addition to those characters described by Boles (2005a), we note the following two significant features.

1. The crista medialis hypotarsi is relatively much longer than in *Gallinula* species, extending to greater than half the length of the hypotarsus, which contributes to the strong enclosure of two hypotarsal canals, as it does in *Heliornis*. This crista is very short in most rallids (e.g., *Gallinula, Gallirallus* and *Porphyrio*), always much less than half of the hypotarsus length. The enclosure of the two canals is a feature approached in *Gallinula*, in which two canals are enclosed plantarly, but that for tendinal canal 2 (*sensu* Mayr, 2004: fig. 5) for the tendon of M. flexor perforatus digiti II (equals canal 2 of Strauch, 1978: fig. 29) is only partly or not closed. In both *Fulica atra* and *F. americana*, tendinal canal 1 (for the tendon for M. flexor digitorum longus) is fully enclosed and tendinal canal 2 is nearly closed. *Amaurornis* species variably have tendinal canal 1 closed or open, with tendinal canal 2 open. *Porzana* species have tendinal canal 1 closed, or tending so, and tendinal canal 2 open, but *Poliolimnas* species have both open.

However, closure of any tendinal canals clearly distinguishes *A. disneyi* from *Gallirallus* and its flightless relatives and *Rallus*, in which both canals are open plantarly. In *A. disneyi*, the greater extent of the crista medialis hypotarsi results in the more plantar of the two canals having carried two tendons, those for M. flexor perforatus digiti II and M. flexor perforans et perforatus digiti II (*sensu* Mayr, 2004). This arrangement is also seen in *Heliornis*. In all *Gallinula* species, the tendon for M. flexor perforans et perforatus digiti II lies in a groove that is open plantarly.

2. The tarsometatarsus is proportionally far longer than in any *Gallinula* species. The groove passing from the sulcus extensorius mediad around the shaft for the M. extensor hallicus longus (Owre, 1967) is located half way down the shaft in rallids. In the more complete QM F20799, the midpoint of this groove is 43 mm from the proximal end, suggesting a total length of about 86 mm. Such an elongate shaft is also supported by the observation that the groove traverses the medial surface at a shallower angle than in *Gallinula* and that the cristae plantares medialis et lateralis remain parallel over the entire preserved length of the fossil. The tarsometatarsus of *A. disneyi* is thus about 1.6 times as long as the femur, which was estimated above at about 54 mm (based on QM F36542). This is also in accordance with the elongate tibiotarsus mentioned above. In *Gallinula* species, the tarsometatarsus is only slightly longer than the femur.

Australlus gagensis n.sp.

Figs 4–6; Table 2

Holotype. QM F54511, complete right humerus (Fig. 4).

Diagnosis. A flightless rail having the diagnostic characters of the genus *Australlus* that differs from *A. disneyi* by its considerably larger size (humeral proximal width and distal width are 117.5% and 116.5%, respectively, of the largest values for *A. disneyi*) and by having the humeral facies bicipitalis in the area overlying the corpus depressed into a distinct depression relative to the intumescentia humeri and caput humeri; a near obsolete sulcus lig. transversus that is separated from the incisura capitis by a caudocranially thicker ridge; a less prominent proc. supracondylaris dorsalis; and proc. flexorius extending markedly further distally than the condylus ventralis.

Table 2. Measurements of fossil rail bones from Riversleigh. Vertebral position determined by comparison with AM O.60402. %L is percentage length of the comparable vertebra in AM O.60402 (Table 1).

Site	Species	Catalogue number QM F	Vertebra #	Length	Width	%L O.60402	%W O.60402
White Hunter	*disneyi*	54507	11	9.9	2.9	99.0	76.3
White Hunter	*disneyi*	54504	12	9.5	3.5	100.0	76.1
White Hunter	*disneyi*	54508	14	6.7	5.2	98.5	91.2
White Hunter	*disneyi*	54506	15	5.7	5.1	91.9	86.4
Dirks Towers	*disneyi*	54509	10	9.9	3.4	92.5	94.4
Golden Steph	*?gagensis*	36354	22	8.2	4.8	101.2	106.6
AL90	*gagensis*	54514	6	11.0	3.8	88.7	126.6

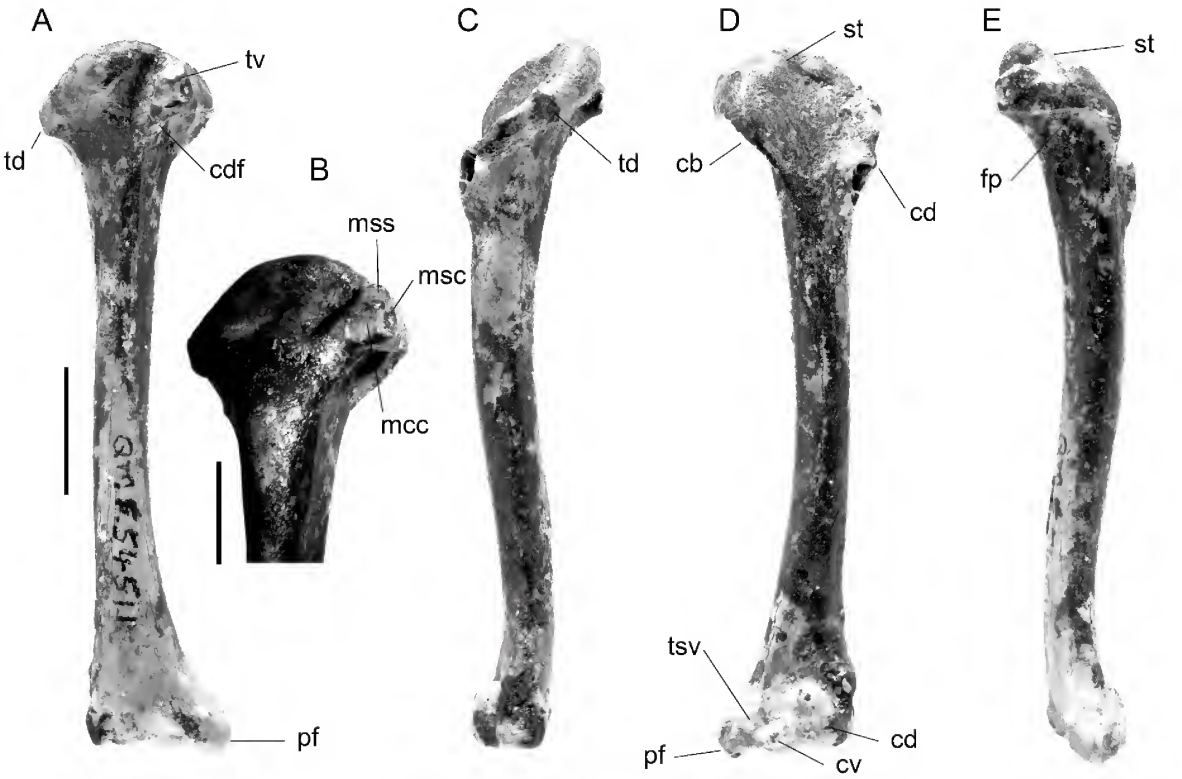

Fig. 4. Left humerus of *Australlus gagensis* (holotype) QM F54511 in caudal *(A,B)*, dorsal *(C)*, cranial *(D)*, and ventral *(E)* views. Abbreviations: *cb*, crista bicipitalis; *cd*, condylus dorsale; *cdf*, crus dorsale fossae; *cdp*, crista deltopectoralis; *cv*, condylus ventrale; *fp*, fossa pneumotricipitalis; *mcc*, M. coracobrachialis caudalis; *msc*, M. subcoracoideus; *mss*, M. subscapularis; *pf*, processus flexorius; *st*, sulcus lig. transversus; *td*, tuberculum dorsale; *tsv*, tuberculum supracondylare ventrale; *tv*, tuberculum ventrale. Scale bar left of A is 10 mm (for A, C, D, E); scale bar left of B is 5 mm.

Measurements (mm) of holotype. Length, 54.3; proximal width, 13.4; shaft width at mid-length, 4.4; maximum distal width, 11.3; depth of condylus dorsalis, 6.1.

Type locality. AL90 Site, Gag Plateau, Faunal Zone C, Riversleigh World Heritage Property, Boodjamulla (Lawn Hill) National Park, northwestern Queensland (Archer *et al.*, 1989, 1994; Creaser, 1997; Travouillon *et al.*, 2006). Details of the site locality are available from the University of New South Wales or Queensland Museum on request.

Stratigraphy, age, fauna and depositional environment. AL90 Site is a fossil cave pitfall deposit formed within the freshwater limestone at the Riversleigh World Heritage Property. The site is considered part of Riversleigh's Faunal Zone C deposits, which, based on stage of evolution of contained mammal taxa and faunal correlation, is Middle Miocene in age (Archer *et al.*, 1997, 2006; Creaser, 1997; Travouillon *et al.*, 2006).

Paratype. QM F54536, R coracoid lacking sternal end, AL90 Site (Fig. 5).

Measurements (mm) of paratype. Preserved length 25.0; length facies artic. humeralis from cotyla scapularis 5.3; maximum width proc. procoracoideus—lateral side cotyla scapularis 7.8; maximum length cotyla scapularis to proc. acrocoracoideus 7.4; width cotyla scapularis 4.5.

Referred material. QM F31479, distal L femur, Ringtail Site (previously referred to *A. disneyi*), referred to *A. gagensis* on basis of larger size than *A. disneyi* (midshaft width 5.6 mm, distal width >13 mm, depth lateral condyle 11.5 mm); QM F54512, distal L tarsometatarsus (missing trochleae metatarsi II and IV), Jim's Jaw Site. This fragment is of a significantly larger rallid tarsometatarsus than those referred to *A. disneyi*, and for this reason it is tentatively referred to the new species. QM F54514, vertebra number 6, from AL90 Site is referred to *A. gagensis*, because while it is of similar size (length) to those from, for example, White Hunter Site or *G. tenebrosa* AM O.60402 (Table 2), the centrum is proportionally wider and it is also much deeper, with the facies articularis caudalis 2.7 mm deep compared to 2.1 mm in *G. tenebrosa* AM O.60402. The single rail bone from Golden Steph Site, QM F36354, vertebra number 22, also has a stouter centrum and a larger neural canal than *G. tenebrosa* AM O.60402, though it does not differ much in length (Table 2), so is also tentatively referred to *A. gagensis*.

Etymology. The species is named after the Gag Plateau, where fossil sites containing it were located.

Description

This species differs from *A. disneyi* by its larger size and diagnostic humeral characters listed above (Fig. 4). The marked depression of the facies bicipitalis is lacking in *A. disneyi* and is likely associated with *A. gagensis* having evolved in flightless state for a longer period. Whereas in most *Gallinula* and *Gallirallus* species, there is no similar

depression, in the flightless taxa that are the most divergent from the volant condition (such as Gallirallus australis and *Gallinula mortierii*), a similar depression is seen, but in both of these species the depression is shallower. Similarly, the fossa pneumotricipitalis is shallower, and the crista deltopectoralis more thickened than in *A. disneyi*. The brachial fossa is relatively shallower than in *A. disneyi* and does not undercut the tuber. supracondylare ventrale. All these features likely are associated with this taxon having been flightless longer than *A. disneyi*. As in *A. disneyi*, ventrodorsal overlap of the condyli dorsalis and ventralis is apparent.

In addition, some features are further exaggerated from the condition seen in *A. disneyi*. For example, the crus dorsale fossae is relatively stouter and the tuber. ventrale is more massive and clearly shows the generic autapomorphic triangular arrangement of the three ligamental scars that are of near equal size: that for M. coracobrachialis caudalis is positioned dorsad of that for M. subcoracoideus, which is oriented somewhat ventrally, and that for M. subscapularis is distinctly craniad of the other two scars, not on the facies lining the incisura capitis, but rather is oriented caudoproximally. We do not consider that this structure of the tuber. ventrale is related to the flightless condition: in the humerus of all *Gallirallus* and *Gallinula* species, no matter how altered by their flightless condition, the tuberculum is caudocranially elongate, with the elongate scars for lig. m. subscapularis and lig. m. subcoracoideus positioned adjacent to each other and markedly cranial to a much larger ovate scar for lig. m. coracobrachialis caudalis on the caudal tip of the tuberculum. The arrangement described for *Australlus* was not observed in any other gruiform taxon examined.

The paratype coracoid (Fig. 5) is larger and more robust than coracoids of *A. disneyi* with a shallower cotyla

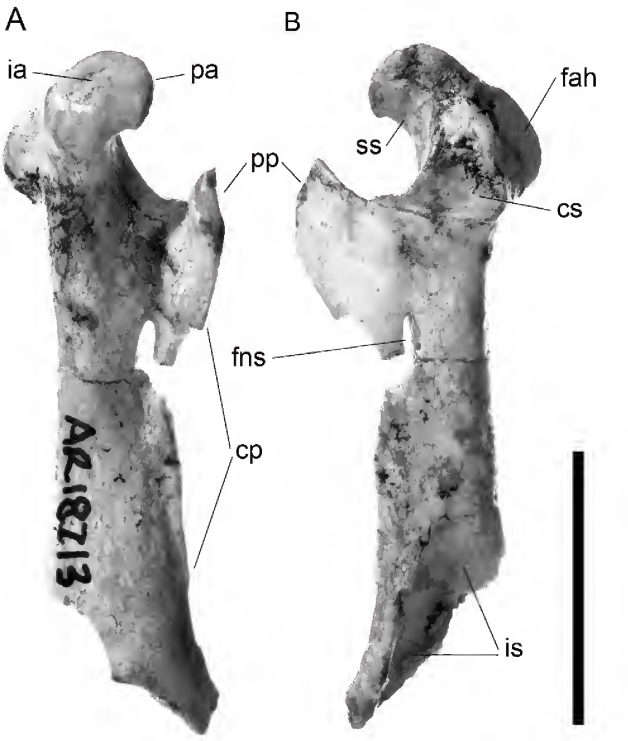

Fig. 5. Right coracoid of *Australlus gagensis* (paratype) QM F54536 in ventral view *(A)* and dorsal view *(B)*. Scale bar is 10 mm. Abbreviations: *cp*, crista procoracoidei; *cs*, cotyla scapularis; *fah*, facies artic. humeralis; *fns*, foramen nervi supracoracoidei; *ia*, impressio lig. acrocoracohumeralis; *is*, impressio m. sternocoracoidei; *pa*, processus acrocoracoideus; *pp*, processus procoracoideus; *ss*, sulcus m. supracoracoidei.

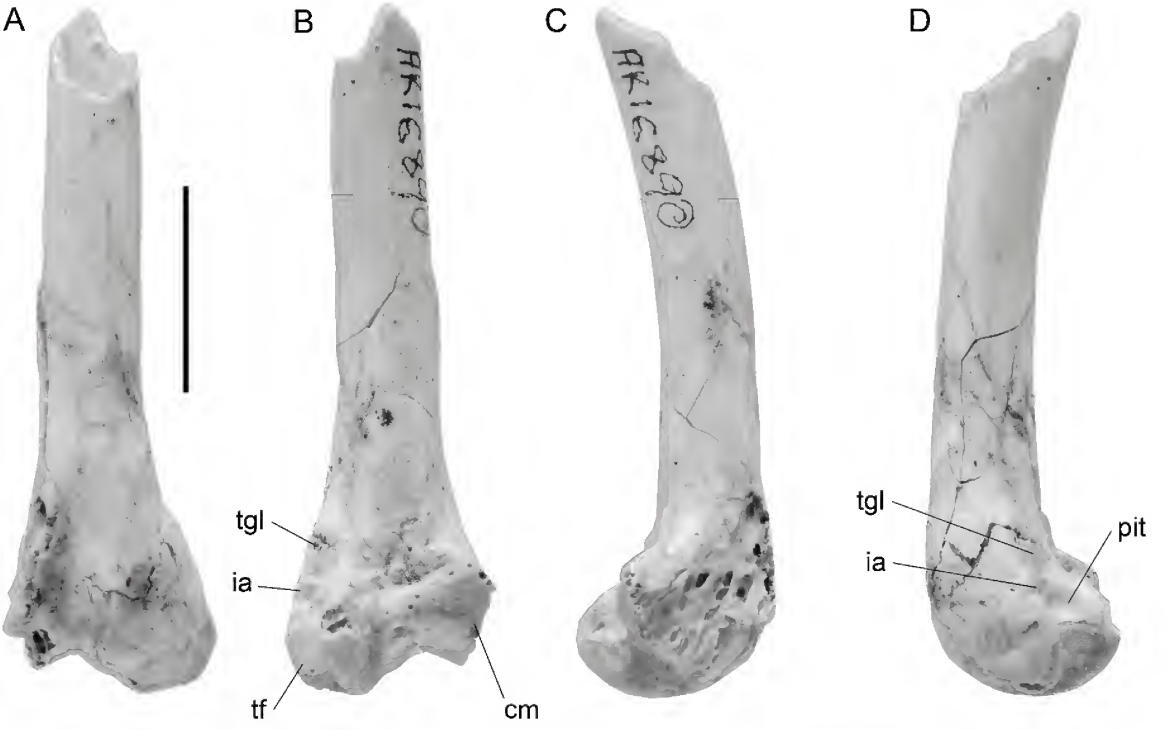

Fig. 6. Distal left femur, QM F31479, referred to *A. gagensis* in anterior *(A)*, caudal *(B)*, medial *(C)* and lateral *(D)* views. Abbreviations: *cm*, condylus medialis; *ia*, impressio M. ansa iliofibularis caudalis; *pit*, pit for the fibular stop; *tgl*, tuberculum gastrocnemialis lateralis; *tf*, trochlea fibularis. Scale bar is 10 mm.

scapularis. It has a large and elongate foramen nervi supracoracoidei with foramina penetrating the corpus. The sharp-edged crista procoracoidei extends c. 14 mm from the cotyla scapularis sternally and merges with the shaft about 1.0 mm cranially and slightly ventrally of the crista medialis: if both crista were extended, they would overlap ventrodorsally. The proc. acrocoracoideus overhangs the sulcus m. supracoracoidei and, as in *A. disneyi*, is aligned at about 45 degrees in a dorsocranial–ventrosternal plane. However, it is less protuberant over the sulcus than *A. disneyi*, extending less medially than its height cranial to the sulcus (in *A. disneyi*, medial extent is similar to cranial extent). Unlike in *A. disneyi*, the impressio lig. acrocoracohumeralis is flat, lacking both a shallow sulcus and transverse groove. Also, in contrast to *A. disneyi*, the ventral facies of the shaft is broadly convex so that the adjacent lateral facies is rounded and lacks the distinct flattened surface seen in *A. disneyi*. As in *A. disneyi*, the proc. procoracoideus extends cranially of the cotyla scapularis. The preserved part of the impressio m. sternocoracoidei is deeper than in *A. disneyi*, and it is bound medially by a strongly overhanging crest.

The new species is also represented by a distal femur QM F31479, previously referred to *A. disneyi*, from which it is distinguished by much larger size (Fig. 6). It has a distinct pit for the fibular stop and shows that the tuber. gastrocnemialis lateralis abuts the impressio m. ansa iliofibularis caudalis on the caudolateral border of the trochlea fibularis, as it does in *Gallinula ventralis*. This tuberculum is distinctly separated from the ansa impression in *G. tenebrosa, G. mortierii* and *Porphyrio porphryio*. The pit for the fibular stop is distinct and deep in *G. ventralis*, but shallow and indistinct in *G. tenebrosa* and *G. mortierii*. In species of *Amaurornis* and *Porphyrio*, it is distinct.

Rallidae, gen. et sp. indet.

Material. A single specimen, QM F54524 (= AR19964), represents a third species of rallid in Riversleigh deposits. It is the left articular of a mandible preserving the part caudal to the fenestra rostralis mandibulae, including the base of the surangular and the cotyla, but it is lacking the medial process and the tip of the processus retroarticularis (Fig. 2).

Location. Ringtail Site, considered part of Riversleigh's Faunal Zone C deposits and hence of Middle Miocene age (Archer *et al.*, 1997, 2006; Creaser, 1997; Travouillon *et al.*, 2006).

Description

It is considerably smaller than *A. disneyi* (preserved length 9.3 mm, length of cotyla lateralis 3.1 mm, total anterior width across cotyla 3.8 mm). It has the general form of rallids with the following notable features: 1, the dorsal margin of the crista transversus fossae linking the caudal part of the cotyla lateralis and the processus medialis is near level with only a slight concavity at mid-width, as in *A. disneyi*, but differing from all rallids examined that have a marked notch in this crista; 2, the cotyla medialis is wider than the cotyla lateralis and extends laterally to the surangular, unlike all rails examined, except *Amaurornis* and *A. disneyi* (generally rallids have the base of the surangular aligned with the junction of the two cotylae); 3, the fenestra caudalis mandibulae is small, as in *A. disneyi*, but the feature varies among rails, being similarly small in *Amaurornis, Dryolimnas pectoralis*, and *Rallina*, but relatively larger in *Gallinula ventralis, Porzana tabuensis* and *Gallirallus philippensis*; 4, the fenestra caudalis mandibulae is located relatively far anteriorly such that the distance from it to the cotyla lateralis exceeds the length of the cotyla lateralis laterally, versus this distance being equal to or shorter than the cotyla in all modern rallids examined.

Apart from being much smaller than *A. disneyi*, this specimen differs as follows: 1, the cotyla lateralis is better emarginated and raised anteriorly; 2, whereas the lateral facies forms an inflated crest on which lies the attachment of ancora ligamenti jugomandibularis externus, the facies is concave above this attachment (convex); and 3, the lateral crest extends anteriad below and anterior to the fenestra caudalis mandibulae (ends caudal to fenestra).

Results of phylogenetic analysis of *Australlus disneyi*

We were able to score 134 characters of the 381 in Livezey's (1998) dataset (Appendix 1) for *A. disneyi*. For *Australlus gagensis*, the 23 characters of the humerus and 11 of the coracoid able to be assessed do not differ from the states in *A. disneyi*. These taxa differ mainly by size and the other differences listed above are not captured by Livezey's (1998) characters, so *A. gagensis* was not included in the phylogenetic analysis. Initial analyses used all taxa in Livezey's (1998) dataset and in these the relationship of *Australlus disneyi* was recovered as sister to the clade of *Porphyrio* and relatives in a topology of a strict consensus tree otherwise very like that obtained by Livezey. However, the many taxa with considerable missing data contributed to a very large number of shortest trees and many taxa grouped in polytomies. In order to better resolve the tree, taxa were successively trimmed until all those listed in Methods were excluded. Analyses also included ordering characters as used by Livezey (1998) but, as the results did not differ significantly, we ultimately chose to present analyses of the modified database that treated all characters as unordered. In all preliminary analyses, the tree topologies we obtained were similar to, if not the same as, that presented by Livezey (1998). For our preferred analysis with 51 ingroup taxa, all characters were treated as unordered and with equal weight. A heuristic search with 1000 replicates found 1176 shortest trees, length = 805, consistency index = 0.5317, homoplasy index = 0.4683 and retention index = 0.8381.

As found by Livezey (1998), separation of the various gruiform families was well corroborated, but resolution within the Rallidae was poorly supported, although the strict consensus tree (Fig. 7) was relatively well resolved. The *Gallirallus*-type rails formed a clade sister to gallinules and crakes (e.g., *Porzana*), with all other rallids forming more basal branches in a tree with the same topology as found by Livezey (1998). The analysis strongly supports the inclusion of *Australlus disneyi* (and thus *A. gagensis*) in the Rallidae. Furthermore, within the Rallidae, *Australlus* is part of a clade of all rallids except *Himantornis* and *Gymnocrex*. The analysis suggests a weak affinity of *Australlus* with swamphens (*Porphyrio* and relatives), with which it formed a sister group (bootstrap support 54%), but perhaps equally likely is that *Australlus* forms an independent lineage from

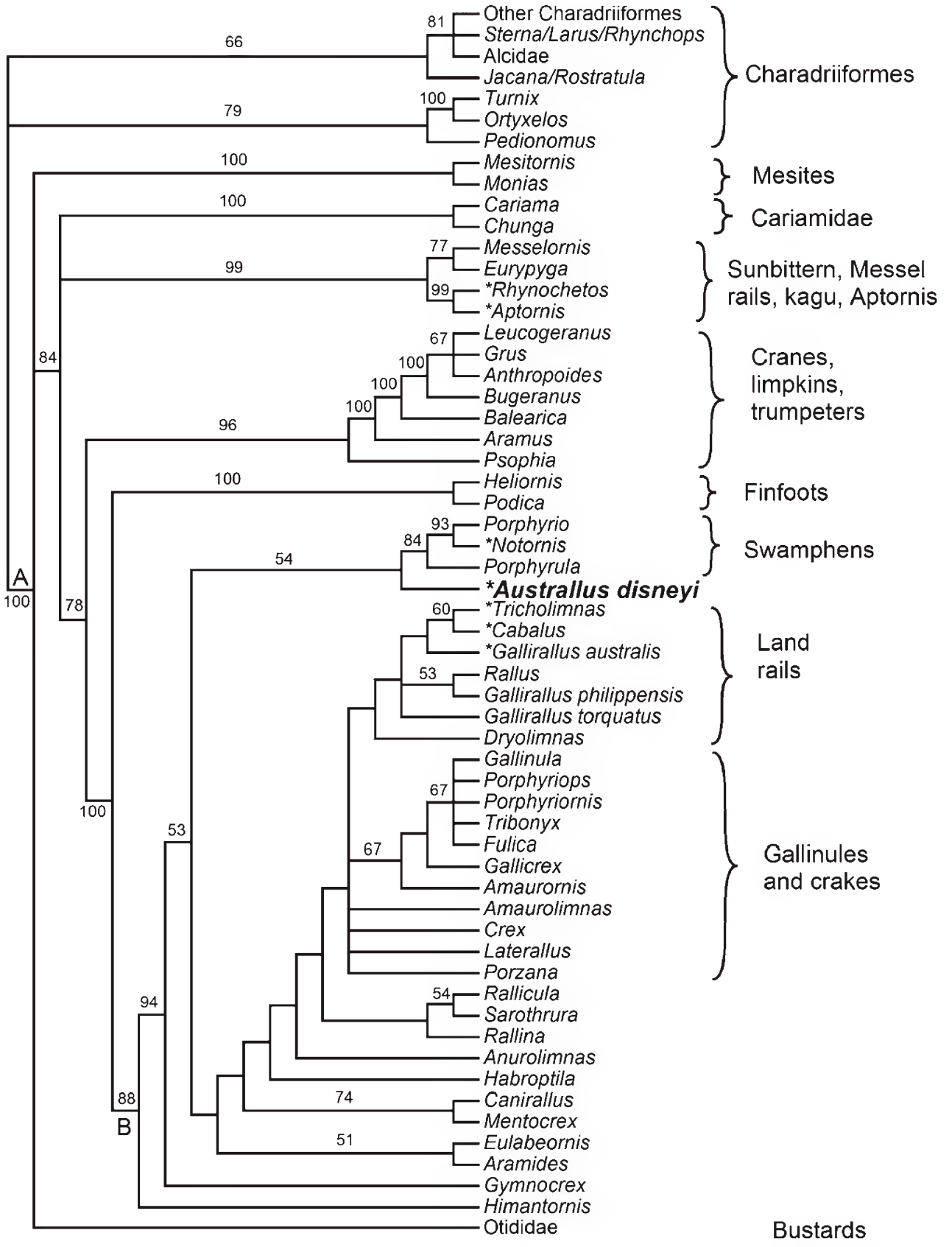

Fig. 7. A strict consensus tree obtained from Livezey's (1998) dataset, modified as described in Methods and incorporating *Australlus disneyi*. Bootstrap support >50% are shown for clades. Asterisks mark flightless taxa, although *Tribonyx* contains one flightless and one volant taxon. "A" marks the clade of Gruiformes and "B" that of the Rallidae.

the rallid stem of similar grade to *Porphyrio*. No support was found for the inclusion of *Australlus disneyi* with true gallinules, which were united in a clade with bootstrap support of 67% and deeply nested in the tree. These data suggest that *Australlus* should be considered to comprise relatively basal rallids, perhaps with some affinity to swamphens.

Discussion

We reviewed all the Oligo-Miocene gruiform fossils from the Riversleigh World Heritage Property, and found three species to be represented. All are rallids. The phylogenetic relationships of the previously described *Gallinula disneyi* were reassessed using existing and newly referred material and the species is transferred to *Australlus* gen. nov. In addition, we report a second, congeneric species that possibly co-existed with *A. disneyi*, assuming the fossils in Ringtail Site had contemporaneous deposition, which, given the aquatic nature of the depositional environment (Archer *et al.*, 1994), is likely.

The specific recognition of *A. gagensis* is not dependent on size differences from *A. disneyi* alone. There is a suite of morphological characters by which these species can be separated. Australian rails show minor sexual size dimorphism, with considerable overlap in measurements between the sexes (Marchant & Higgins, 1993). The size difference between *A. disneyi* and *A. gagensis* is considerably greater than that between sexes of living taxa; thus, there is no support for the possibility that the two size classes represent different sexes of the same species. In addition, the distribution of size classes is very skewed temporally and unlikely to be that of a single, dimorphic species.

Our morphological and phylogenetic analyses demonstrate that the original allocation of *disneyi* to *Gallinula* was incorrect. An immediate ramification of this is the suggestion by Boles (2005a) that *disneyi* might have been the ancestor of *Gallinula mortierii* can be rejected. The new genus instead includes relatively basal rallids, distant from *Gallinula*, but with a weak sister-group relationship with *Porphyrio*. Although the original generic identification was incorrect, the species is still the oldest known representative of crown group Rallidae (cf. Mayr, 2009) because it lies within a clade defined by the common ancestor of *Himantornis* and *Fulica* or *Rallus* and all its descendents (Fig. 7).

The molecular study of Fain *et al.* (2007) recovered a divergence time for the base of the Rallidae of 21.8 Ma (95% credible interval 35.6–12.9 Ma). If *Australlus disneyi* did belong with the *Gallinula-Porzana* clade, then this would provide a strong challenge to this timing, because gallinules and crakes are regarded as among the more derived rallids. An occurrence of *Gallinula* species in Late Oligocene Faunal Zone A would require an extraordinarily rapid diversification with the Rallidae after its divergence. The finding of our analysis that *A. disneyi* belongs to a more basal genus does not overcome this problem, but it considerably reduces its magnitude. The position of *Australlus* indicates that it is part of crown-clade Rallidae and not a stem-taxon. Cranial material for *A. disneyi* reveals that this species had a conservative short, non-robust bill typical of basal taxa such as *Gymnocrex*, and most unlike the heavily built bills of swamphens, or the long, slim bills found in some specialized forms.

Both species of *Australlus* were flightless, as evidenced by the limb proportions (Boles, 2005a) or just humeral features alone that are found in flightless rallids such as *Gallirallus australis* and *Gallinula hodgenorum* (for example, a more accentuated margo caudalis adjacent to the crus dorsale fossa, relatively small crista bicipitalis and crista deltopectoralis rotated onto cranial facies rather than on dorsal margin and concave caudodistally).

The fossa pneumotricipitalis and, particularly, the sulcus lig. transversus, both of which are relatively shallow in *A. disneyi* compared to volant rallids, are much shallower in *A. gagensis* than in *A. disneyi* indicating a progression with presumed length of time since flightlessness was achieved. In addition, the development of a distinct depression in the humeral facies bicipitalis bound by the intumescentia humeri, caput humeri and crista deltopectoralis, as seen in *Gallirallus australis*, is consistent with the geologically younger species having been flightless a longer period of time. A parallel morphological transition is seen in the coracoid. That of *A. gagensis* is not only larger, but it has a more reduced proc. acrocoracoideus as expected of a bird whose lineage has been flightless longer.

Extant and recently extinct flightless rails almost always occur on islands. *Gallinula* had two exceptions that occupied larger landmasses in the Pleistocene: *G. hodgenorum* of New Zealand and extant *G. mortierii* of mainland Australia. *Australlus* provides another instance, but even more unusual in that more than one flightless species occurred on a mainland situation.

If we exclude the Ringtail Site, *Australlus disneyi* has been recovered only from Faunal Zones A and B, while *A. gagensis* is known only from Faunal Zone C. Therefore, it could be possible that they represent a temporal series. An increase in size is seen in several lineages between Faunal Zones A and B and Faunal Zone C (for example, many kangaroo and diprotodontoid lineages). The co-occurrence in Ringtail Site, usually attributed to Fauna Zone C, of both *A. disneyi* and *A. gagensis*, however, challenges this possibility. If QM F20799 is correctly attributed to the Ringtail fauna, a temporal series is still a possibility if the Ringtail Site is considered to be early Faunal Zone C and AL90 late Faunal Zone C. The large size of the tarsometatarsus QM F20799 could be interpreted to mean that it and the femur QM F31479, referred to *A. gagensis*, might represent an intermediate temporal form. Alternatively, the co-occurrence of both forms may reflect at least partial temporal overlap and sympatry of the two species. The rarity of *A. gagensis* makes it probable that the temporal range of this species is not yet established and that habitat differences, combined with biases in placement of fossil deposition sites, have combined to create an illusion of temporal separation of these taxa. Only further fossils can resolve these conflicting scenarios.

There is further reason to doubt the association of the Ringtail Site fauna with that of typical Faunal Zone C faunas. In most analyses, the Ringtail Site grouped with System C sites (Travouillon *et al.*, 2006), but in some, such as cluster analyses based on sites with more than eight mammal taxa, it grouped with System B sites. Worthy (2009) tentatively identified the anseriform *Pinpanetta tedfordi* from Ringtail, which if correct, indicates an affinity with sites in the Etadunna and Namba Formations of South Australia. This would support an age for Ringtail closer to Late Oligocene or Early Miocene and hence that this site might belong to

Faunal Zone B or early Faunal Zone C. The identification of *Australlus disneyi* from Ringtail Site, if the bone is correctly attributed to site, supports the suggestion that Ringtail is older than other Faunal Zone C sites and that it most likely belongs to Faunal Zone B. Assemblages characterizing Riversleigh's Late Oligocene Faunal Zone A are most recently identified as derived from an open forest habitat, whereas the Early Miocene Faunal Zone B and Middle Miocene Faunal Zone C assemblages derive from rainforest habitats (Travouillon *et al.*, 2009).

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Appendix 1. Scoring of 381 characters for analysis in Livezey's (1998) matrix; * score for character 244 is (02).

Gallinula disneyi

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                                                                                                                  1
         1 1111111112 2222222223 3333333334 4444444445 5555555556 6666666667 7777777778 8888888889 9999999990
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Appendix 2. A list of all rallid specimens from Riversleigh by Faunal Zone.

Faunal Zone A

Australlus disneyi. White Hunter Site: mandible (QM F54503), vertebrae (QM F54506, QM F54504, QM F54507, QM F54508, QM F54515), humerus (QM F20906, QM F31471, QM F31472, QM F45457), coracoids (QM F31469, QM F31470, QM F54513), tibiotarsus (QM F31473, QM F31474, QM F31475), tarsometatarsus (QM F23723, QM F31476); LSO Site: femur (QM F36452).

Faunal Zone B

Australlus disneyi. Camel Sputum Site: cranium (QM F23806), premaxilla (QM F54505), carpometacarpus (QM F31478, QM F31477), tibiotarsus (QM F24130, QM F30696); Dirk's Towers Site: vertebrae (QM F54509, QM F54510), ulna (QM F30693), carpometacarpus (QM F30908), coracoid (QM F30692), tibiotarsus (QM F31480); Judith's Horizontalis Site: coracoid (QM F39864); Wayne's Wok Site: premaxilla (QM F30864); Creaser's Ramparts Site: tarsometatarsus (QM F30720).

Faunal Zone C

Australlus disneyi. ?Ringtail Site: Tarsometatarsus (QM F20799),
Australlus gagensis. AL90 Site: humerus (QM F54511), vertebra (QM F54514), coracoid (QM F54536); Ringtail Site: femur (QM F31479).
?Australlus gagensis. Golden Steph Site: vertebra (QM F36354); Jim's Jaw Site: tarsometatarsus (QM F54512),
Rail species 3 Ringtail Site: mandible (QM F54524).

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Larvae of *Belonepterygion fasciolatum* (Plesiopidae: Acanthoclininae)

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ABSTRACT. Larvae of *Belonepterygion fasciolatum* (in the plesiopid subfamily Acanthoclininae) are described based on two postflexion, pelagic specimens from Espirito Santo, Vanuatu (5.7 mm SL) and Magnetic Island, Great Barrier Reef, Australia (6.3 mm SL), as well as two settled individuals (9.4 and 11.9 mm SL) from One Tree Island, Great Barrier Reef, Australia. Distinct morphological characteristics of acanthoclinins form early in development (c. 6 mm SL), including weak head spination limited to a single opercular spine, a large oblique mouth and three unbranched lateral lines. Dorsal and anal fins have many more spines than soft rays, dorsal and anal fin spines have thickened fleshy pads distally, the body is relatively slender with a deep, short caudal peduncle. Pigmentation consists of melanophores more-or-less evenly distributed across the trunk and head as well as a pale brown background (not obvious melanophores, the colour of skin and muscle) on the body that intensifies with growth. These are the first tropical acanthoclinin larvae to be reported. For reasons that are unclear, larvae of tropical and warm-temperate acanthoclinin species are rare in collections, but cool-temperate acanthoclinin larvae can be abundant.

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The plesiopid subfamily Acanthoclininae (formerly considered a separate family, see Mooi, 1993) consists of 13 species in four genera of small (210 mm, max. standard length), Indo-Pacific reef-associated fishes. Two of the genera, *Acanthoplesiops* (Regan) and *Belonepterygion* (McCulloch) are found on shallow tropical coral and rocky reefs. Of the other two, *Beliops* (Hardy) is found in both tropical and temperate areas whereas *Acanthoclinus* (Jenyns) is confined to temperate regions of Australia and New Zealand (Hardy, 1984; Neira, 1998; Smith-Vaniz & Johnson, 1990). The single species of *Belonepterygion* is distinguished from those of *Acanthoplesiops* and *Beliops* by the presence of three lateral lines compared to one in the latter two genera, and from *Acanthoclinus* by dorsal and anal-fin spine and ray counts (Smith-Vaniz & Johnson, 1990).

Acanthoclinin early-life history is poorly known, but seems to be broadly similar to that described for other plesiopid subfamilies (Neira, 1998; Leis & Trnski, 2004). Both ovarian and spawned eggs have been described for *Belonepterygion fasciolatum* (Ogilby) (Mooi, 1990; Gill & Mooi, 1993) while only spawned eggs are described for *Acanthoclinus littoreus* (Forster), formerly recognized as two species, namely *Acanthoclinus quadridactylus* (Bloch & Schneider) and *Acanthoclinus trilineatus* (Griffin) (Smith-Vaniz & Johnson, 1990). Spawned eggs are of moderate size (c. 1.4–1.7 mm diameter) and are bundled as demersal, spherical egg masses (5–8 cm in diameter) held together by adhesive threads (Jillet, 1968a,b; Johnson, 1984; Mooi, 1990). The threads are attached evenly on eggs in both species, with *B. fasciolatum* having twice as

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many attachments as *A. littoreus* (see Mooi, 1990). Larvae of only three acanthoclinin species have been described or illustrated in the literature: *Beliops xanthokrossos* (Hardy) (Neira, 1998; Neira *et al.*, 1998) from western Australia, and *A. littoreus* (as *A. quadrydactylus*, Jillet, 1968a,b; Crossland, 1981) and *A. quadrydactylus* (see Crossland, 1982) from New Zealand. Fin meristics of *A. quadrydactylus* in Crossland (1982) (D XIX, 4; A X, 4) do not correspond to *A. quadrydactylus* (now considered a synonym of *A. littoreus*). Of the species found in New Zealand waters, the fin meristics correspond only to *Acanthoclinus marilynae* (Hardy), hence we consider Crossland's illustration to be *A. marilynae*. Acanthoclinin larvae hatch at about 4.7 mm (Jillet, 1968a,b) and settle at 6.3–9.4 mm after a relatively short pelagic larval period with direct development (based on the largest pelagic larva and smallest settled individual examined in this study).

Belonepterygion fasciolatum is considered one of the more widespread species in the subfamily occurring from southern China to southern Queensland and Lord Howe Island, Australia. Despite it's widespread distribution, larvae of this species were previously unknown. Our purpose here is to describe larvae of this species based on specimens from plankton tows in Australia and Vanuatu, and compare them with two small, apparently recently settled individuals from Australia.

Materials and methods

Two pelagic specimens of postflexion *B. fasciolatum* larvae were examined: 5.7 mm SL (NSMT PL710, Vanuatu [c. 15°15'S 166°50'E], plankton tow) and 6.3 mm SL (AMS I.24206-004, near Magnetic Island, central Great Barrier Reef, Australia [19°05'S 146°51'E] oblique Tucker Trawl). The larva from the Great Barrier Reef was fixed in formalin and both were preserved in 70% ethanol at the time of this study. Measurements and abbreviations follow Leis & Carson-Ewart (2004). Lengths are standard length (SL), and percentages are of SL unless noted otherwise. Pigment refers to background colour of larvae and melanophores in preserved specimens. Specimens were examined under a dissecting microscope and measured using an ocular micrometer. Illustrations were prepared with the aid of a camera lucida and a digital graphics tablet. Two settled specimens, 9.4 and 11.9 mm SL from One Tree Island (23°30'S 152°05'E), Great Barrier Reef, Australia (AMS I. 20210-039) were also examined. In addition, a pelagic larva (5.2 mm SL) of *Beliops xanthokrossos* was also studied (AMS I.43381–001 Wreck Point [31°32'S 155°34'E], Western Australia, 50 cm diameter plankton net).

Larvae were identified as *B. fasciolatum* through characteristics listed by Hardy (1984): specifically the dorsal-fin count of D XVII–XX, 4–5, anal-fin count A X–XII, 3–5, as well as the presence of three unbranched lateral lines. This combination of characters distinguishes them from all other fish species in the Indo-Pacific.

Results

Descriptions of larvae

Larvae of *B. fasciolatum* (Fig. 1) are elongate and of moderate body depth (BD, 34.3% at 5.7 mm and 28.2% at 6.3 mm) and are laterally compressed with the smaller specimen possessing 27 myomeres. Only the posteriormost myomeres are discernable on the larger specimen.

The gut is coiled and extends slightly beyond midbody. The gas bladder is located dorsal to the anterior portion of the gut. Either no gap (VAFL, 0% in the smaller specimen) or a small gap (VAFL, 3.2% in the larger specimen) exists between the anus and the anal fin.

The head is large (34.0–38.0% SL) with a rounded dorsal profile and prominent lower jaw angle. The snout is short (19.2–22.6% HL), concave at 5.7 mm and convex at 6.3 mm. Preanal length is shorter in the small specimen (3.65 mm) compared to the larger specimen (4.13 mm). The eye is small (31–45% HL) and round. The nasal pit is not bridged over in the smaller specimen, but the membranous bridge is forming in the larger specimen. The mouth is large and moderately oblique: 30° in the smaller specimen and 55° in the larger specimen, below the horizontal. The maxilla reaches almost to the posterior edge of the pupil in the smaller specimen but only to the anterior edge of the pupil in the specimen. Teeth could not be seen as lips are fleshy and the mouth of both specimens is closed and could not be opened without risk of damage. An incipient opercular spine is apparent in both specimens where only the shaft of the spine is present without a distinct tip. There are no other spines on head or pectoral girdle

All fins are fully formed. Both specimens are in the postflexion stage and have: D XIX, 4; A X or XII, 4; P_2 I, 2 and 16 (8+8) caudal fin rays (C). In the smaller specimen many of the pectoral fin rays on the left side of the specimen were damaged, however, the right hand side had 17 rays. The larger specimen lacked a full complement of pectoral fin rays on both sides due to damage to the specimen. Adults possess 17–19 pectoral fin rays.

The membrane on dorsal spines is degraded in the smaller specimen but present in the larger specimen, where it extends almost to the tip of the spines and rays. In adults, this membrane is incised to about half of the length of the spine section anteriorly, decreasing posteriorly so that by the last 4 rays the membrane reaches the tips. In addition, spines have fleshy pads distally and the membrane on anal-fin spines is incised about one third the length of the element; the incision decreasing posteriorly. For larvae the tips of dorsal and anal fin spines also have thick fleshy pads (in smaller specimen, dorsal fin spines II–VII and in the larger specimen only on dorsal fin spine IV, probably due to damage). Posterior-most soft rays of dorsal and anal fins with membrane. Pelvic-fin spine 40 % longer than second ray in smaller specimen; broken in the larger specimen, but longer than the ray. Second pelvic-fin ray slender and unbranched. First pelvic-fin ray branched, longer than spine, and much longer than second ray. Caudal peduncle is short (8 and 7% SL) and deep (14 and 12% SL), so that larvae appear squared off posteriorly.

No scales are present on either of the specimens examined. However, three unbranched lateral lines (dorsolateral, midlateral and ventrolateral) run along length of trunk and tail in the form of three single long depressions.

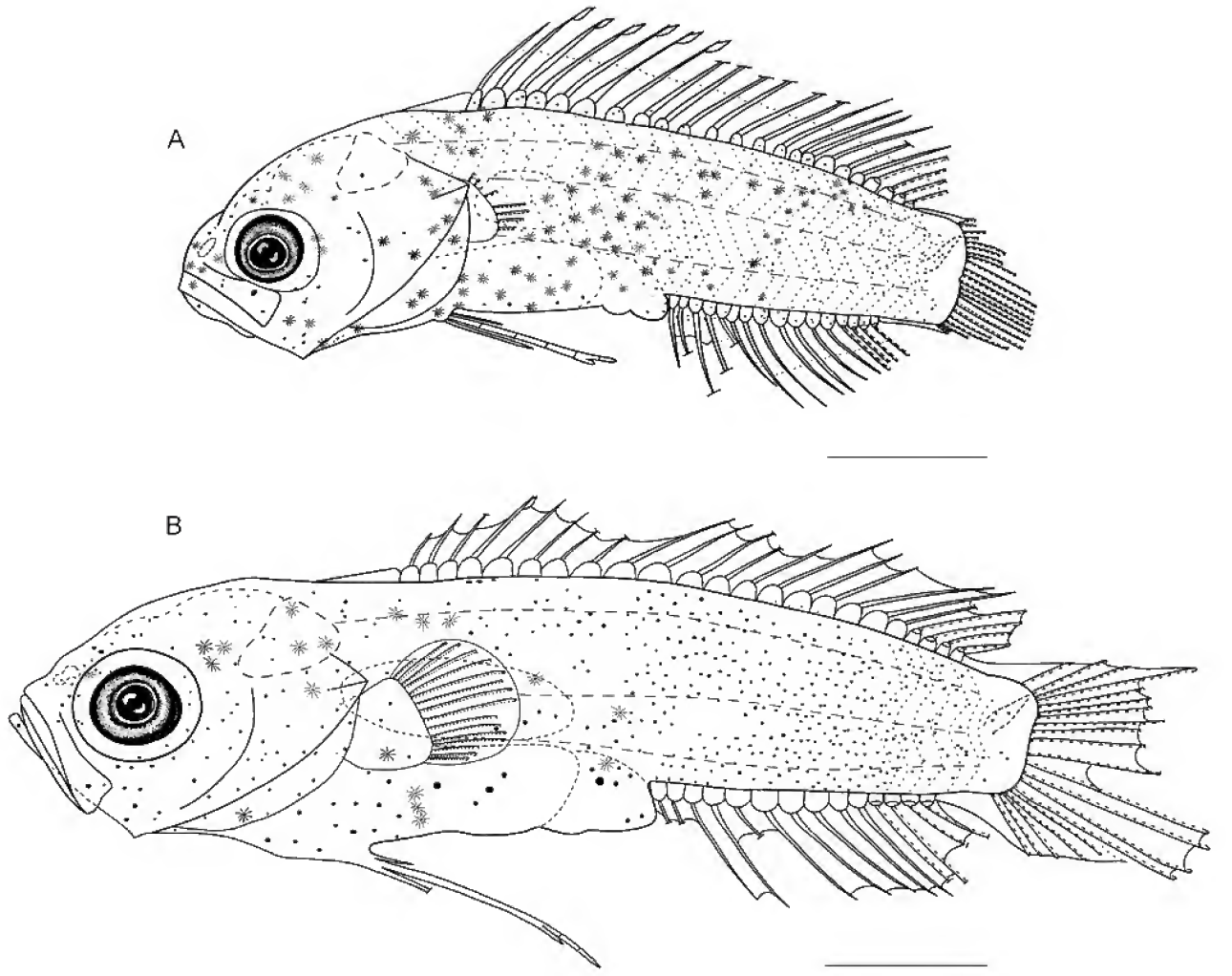

Fig. 1. Larvae of *Belonepterygion fasciolatum*. No scales were present on either of the specimens. The dashed lines on the trunk and tail represent lateral lines (three single long depressions). Background pigmentation not shown in illustrations. *(A)* 5. 7 mm SL (NSMT PL710); postflexion; note opercular spine forming. *(B)* 6.3 mm SL (AMS I.24206-004); postflexion; note reduction in body depth compared to 5.7 mm specimen. Scale bars = 1 mm.

Background pigmentation (not obvious melanophores, but apparently, the colour of skin and muscle) on the body is pale brown that intensifies in larger sized specimen. This background pigmentation is not shown in the illustrations. Stellate melanophores are randomly distributed on the smaller specimen and contracted melanophores dominate the larger specimen. One to two melanophores are present on the bases of spines and rays of the dorsal, anal, pectoral and pelvic fins. Pigmentation extends to all bases and the posterior-most portion of dorsal-fin spines IV–IX and on the first soft ray. The membrane between each spine and to the first ray has the background pigmentation in the larger specimen. Background pigmentation is also present on the membrane between the first spine and first anal-fin ray in the larger specimen. The membrane between the first four anal-fin spines in the smaller specimen is degraded. Caudal, pelvic and pectoral fins are unpigmented. Small melanophores are distributed evenly on body from caudal peduncle to tip of snout.

Settlement-sized specimens

The 9.4 mm SL settled specimen possessed scales forming on the mid-body between the level of the ninth dorsal spine and first ray. The body is fully scaled in the 11.9 mm SL specimen. In both settled individuals the opercular spine has a pointed tip. In adults, the posterodorsal angle of the opercle is produced as a short, rounded spine (Hardy, 1984). In the 9 mm SL specimen, background pigmentation has intensified and pigment is present on all but the first dorsal-fin spines and rays (extending two thirds along each element) and on the fin membrane. In the 11.9 mm SL settlement-sized specimen, this pigmentation reaches the distal end of spines and rays, except that the first dorsal spine remains unpigmented. At 9.4–11.9 mm SL, pigment is present on anal-fin spines and rays including the membrane in between, and some pigmentation is present on the base of the pelvic spine and rays. At 9.4 mm SL pigmentation has begun to form on the caudal rays and membrane from the middle to

distal end and this intensifies by 11.9 mm SL. Numbers of distinct melanophores decrease on the body on settlement-sized specimens yet remain concentrated on the head.

Discussion

Larval development apparently takes place rather quickly in *B. fasciolatum*, with all fins formed by 5.7 mm, and settlement occurring by 9 mm. Although the size at hatch is unknown (probably about 4–5 mm based on other acanthoclinins), it seems that the pelagic phase of this species is brief, as reflected by the rarity of larvae in plankton collections. Jillet (1968a) estimated the pelagic larval duration (PLD) to be as long as 3 months in New Zealand waters. Although growth rates of cold water species are likely to be slower, and thus PLDs longer than those in warmer waters, this inference was based on the seasonal timing of the first egg mass to be discovered and the first appearance of a recruit, a fish c. 10 mm (washed up on shore). Thus, this estimate should be considered with caution, because it may be an overestimate of PLD.

We have examined many larvae from within the range of this species, and have found only the two larvae of *B. fasciolatum* described here, both from inshore locations. Changes over settlement are minimal, and consist primarily of pigment changes, development of the opercular spine tip and the beginning of scale formation. Therefore, larval development of *B. fasciolatum* can be characterized as direct, probably brief, and likely to take place inshore. In contrast, it appears that larval acanthoclinins are reasonably common in plankton hauls in the temperate inshore waters of New Zealand (Crossland, 1981, 1982). Despite having non-pelagic eggs and an apparently brief, inshore larval phase, *B. fasciolatum* has a wide distribution.

Larvae of only four of the 13 species of acanthoclinins are known (*A. littoreus, A. marilynae, B. xanthokrossos* and *B. fasciolatum*), yet all share certain morphological characteristics. With the exception of *A. marilynae* which has a longer snout (38% HL), larger head (27% SL) and more elongate body (BD = 19% SL), all have a similar overall body shape and are heavily pigmented with numerous melanophores. Larvae of *B. fasciolatum* and *B. xanthokrossos* possess 26–27 myomeres and lack pigment on the posterior portion of the caudal peduncle. All fins are fully formed by 5.7 mm SL and settlement occurs between 9.4 and 11.9 mm SL for *B. fasciolatum* and around 13.1 mm SL for *B. xanthokrossos* (Neira, 1998; Neira *et al.*, 1998). Head spination is weak with only a single opercular spine, which is less pronounced in *B. fasciolatum*. Although no published description or illustration of any acanthoclinin larva includes mention of preopercular spines, Johnson (1984) lists larvae of Acanthoclinidae as having the "preopercular posterior margin and sometimes lateral ridge with very small spines or serrations". Johnson (pers. comm.) had no specimens upon which to base his description, and relied on two published descriptions Jillet (1968b) and Crossland (1982), neither of which mention preopercular spination. Johnson informed us that this description of spination was "probably wrong", which seems to be the case.

Larvae of *B. fasciolatum* have a greater body depth (28–34%) than *B. xanthokrossos* (21–23%). Anal-fin counts also differ between these species with *B. fasciolatum* having XI, 4 compared to X, 2–3 in *B. xanthokrossos*. Moreover, larvae of *B. xanthokrossos* have more pigment on the head and body, and lack pigment on the pectoral, caudal and anal fin membranes before settlement. In contrast, larvae of *B. fasciolatum* examined have pigmentation on the anal fin but the pectoral fins are unpigmented in settlement larvae examined. Based on specimens hatched from field-collected egg masses, Jillet (1968a) described larval developmental in *A. littoreus* up to 5.5 mm. By that length and in the preflexion stage, the overall shape of the body, gut and pigmentation pattern are consistent with those of other acanthoclinin larvae. However, fins were not fully formed, thus larvae were not as developed in the smallest larva examined in this study at 5.7 mm. A larva of *A. littoreus* in a later developmental stage (size not noted) was illustrated but not described by Crossland (1982). Again, the shape of the body and gut and the fairly even distribution of melanophores across the trunk and gut, were consistent with those described for other acanthoclinin larvae. Similarly, Crossland (1981) illustrated, but did not describe a larva of *A. marilynae* which also possessed morphological features of acanthoclinins, albeit with a more slender body (BD = 19% SL; Table 1).

Larvae of non-acanthoclinin plesiopids are similar to those of acanthoclinines. Larvae are moderately deep and laterally compressed. The head is moderate to large and the gut is long and fully coiled in larvae less than 5 mm. The gas bladder is located dorsal to the anterior portion of the gut and is usually small and inconspicuous. Scales are not present prior to settlement. Differences include spine and ray counts on all fins. In non-acanthoclinins the number of dorsal and anal-fin spines is lower and the number of rays greater compared to acanthoclinins. Pectoral and pelvic-fin ray counts are also greater in non-acanthoclinin larvae, plus the fin elements are generally developed at smaller sizes in acanthoclinins. Non-acanthoclinins possess a greater number of caudal fin rays (17–18, compared to 16 for acanthoclinins).

Table 1. Morphometric (mm) and meristic values for larvae of *Belonepterygion fasciolatum*. *SL*, standard length; *PAL*, preanal length; *PDL*, predorsal length; *HL*, head length; *ED*, eye (orbit) diameter; *SnL*, snout length; *BD*, body depth, depth at level of pectoral fin base *(P)* and anus *(A)*; *D*, dorsal fin; *A*, anal fin; P_1, pectoral fin; P_2, pelvic fin; *C*, caudal fin; *LL*, lateral lines.

SL	PAL	PDL	HL	ED	SnL	BD(P)	BD(A)	D	A	P_1	P_2	C	LL
5.67	3.65	1.94	1.98	0.90	0.37	1.55	1.46	XIX, 4	XII, 4	17[a]	I, 2	8+8 = 16	3
6.32	4.13	2.35	2.11	0.65	0.53	1.70	1.46	XIX, 4	X, 4	16[b]	I, 2	8+8 = 16	3

[a] Measurement taken from right side of specimen.
[b] Some rays missing.

In addition, non-acanthoclinin plesiopid larvae have 24–40 myomeres; 24–35 in most genera and 37–40 in the Australian temperate genus *Trachinops* (Günther). Larvae can also be lightly (e.g., *Trachinops*) to heavily pigmented (e.g., *Beliops*) with no melanophores around posterior region of caudal peduncle in heavily pigmented larvae.

Pelagic acanthoclinin larvae have only been reported by Crossland (1981, 1982), Neira, (1998) and this study. Larvae of the temperate species *A. littoreus* are reasonably abundant in plankton hauls (with >50 collected in areas close to shore) off the coast of New Zealand (Crossland, 1981, 1982). In contrast, larvae of tropical species such as *B. fasciolatum* and *B. xanthokrossos* are rare. We have observed only two specimens of *B. fasciolatum* and <10 larvae of *B. xanthokrossos* were collected from coastal waters off Freemantle, Western Australia in an extended study (F.J. Neira, pers. comm.).

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The Pelagic Larva of the Midnight Snapper, *Macolor macularis* (Teleostei: Lutjanidae)

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ABSTRACT. A larva of the Indo-West Pacific lutjanid fish *Macolor macularis* Fowler, the Midnight Snapper, is described from a 6.0 mm (standard length) specimen, collected in the western Pacific Ocean (2°58.1'S 158°14.3'E). Although recently settled *M. macularis* have been described, this is the first report of a pelagic larva. The deep-bodied larva is typical of the perciform family Lutjanidae and is characterized by 24 myomeres, laterally compressed head and body, robust, long dorsal and pelvic-fin spines with fine serrations and strong head spination. The larva of *M. macularis* can be distinguished from the similar larvae of *Macolor niger* (Forsskål) by having fin-ray counts of D X, 13 and A III, 10, the greater relative length of the second to third dorsal-fin spine and the lack of any opercular melanophores. Larvae of *Macolor* species are rare, juveniles are not common and adults live to 40–50 years. These facts indicate *Macolor* species have a life history extremely vulnerable to exploitation.

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The two species of the lutjanid genus *Macolor* Bleeker, *M. niger* (Forsskål), the Black-and-white Snapper, and *M. macularis* Fowler, the Midnight Snapper, are, as adults, closely associated with coral reefs and widely distributed in the Indo-Pacific (Anderson & Allen, 2001). In spite of the abundance of adult *Macolor* species on coral reefs, larvae are extremely rare in collections. Knowledge of early life history stages of *Macolor* species is limited to larvae of *Macolor niger* (Leis, 2007) and recently settled individuals of both *M. niger* and *M. macularis* (Kishimoto *et al.*, 1987; Leis, 2007). Until now, no larvae of *M. macularis* have been reported or described. Our purpose here is to describe a single 6.0 mm SL larva of *M. macularis* from the southwest Pacific Ocean north of the Solomon Islands that was found in the collections of the Far Seas Fisheries Research Laboratory, Shimizu, recently transferred to the National Museum of Nature and Science, Tokyo.

Materials and methods

Measurements and abbreviations follow Leis & Carson-Ewart (2004). Lengths are Standard Length (SL). Percentages are of SL. Fig. 1 was prepared with the aid of a camera lucida. Pigment refers to melanophores in preserved specimens. Specimens examined are deposited in Institute of Oceanic Research and Development, Tokai University (IORD) and National Museum of Nature and Science, Tokyo (NSMT).

Identification. The specimen was identified as a lutjanid through the characteristics listed by Leis & Rennis (2004) including: 24 myomeres; laterally compressed body and head; very long dorsal-fin spines (particularly the second) and pelvic-fin spines; fin spines that are smooth to very weakly serrate; longest P2 ray at least as long as P2 spine;

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strong head spination without serrations on preopercular spines; head spination includes, supraorbital ridge, and spines on opercle, interopercle, and on inner and outer borders of preopercle; spines also present on bones of the pectoral girdle, including posttemporal, supracleithrum, and dorsal postcleithrum; no supraoccipital crest or spines; no lachrymal spines or serrations.

The larva was identified as belonging to the genus *Macolor* through its fin-ray counts of D X, 13, A III, 10, and its similarity to larvae of *Macolor niger*. Among lutjanine lutjanids, only *Macolor* spp. have this combination of meristic values. Some species of the caesionine lutjanid genera *Caesio* and *Pterocaesio* have fin-ray counts within the range of the larva described here, but, their larvae have been described and can be distinguished by other characters, most especially by their strongly serrate fin spines and more slender body (Reader & Leis, 1996).

The larva (Fig. 1) is generally similar to those of *M. niger*, differing only in fin-ray counts, length of some fin spines, and some details of pigment. It was identified as *Macolor macularis* by the fin-ray counts of D X, 13 (*M. niger* has D X, 14–15), and A III, 10 (*M. niger* only rarely has 10 anal-fin rays, see Table 1 of Leis 2007). Further, at any size, the ratio of the length of the second dorsal spine to that of the third is greater in the present larva and in settled individuals of *M. macularis* than in *M. niger* (Fig. 2).

Material examined. One pelagic larvae NSMT-PL 369, 6.0 mm SL. Collected by plankton net aboard the Japanese research vessel "Shunyo Maru" in the western Pacific (2°58.1'S 158°14.3'E), station 74M, 18:10–18:30 hrs, 6 Nov 1968. Three recently settled *M. macularis* IORD 82–299A, 82–299B, 85–316, 16.8–20.3 mm collected Iriomote Isl, Ryukyu Isls (Leis, 2007) were also used.

Description

Figs 1, 2, Table 1

Macolor macularis, 6.0 mm. Body compressed and deep, slightly decreasing in depth from 46% at 6.0 mm to approximately 40% at 17–20 mm following settlement. Body deeper at P1 base than at anus. Gut broadly triangular, coiled and compact, with virtually no gap between anus and anal fin. Prominent gas bladder immediately dorsal to apex of gut. Caudal peduncle of moderate depth and length. Myomeres for the 6.0 mm specimen were 11+13 = 24.

Head large, compressed and consistent in size ca 39% at flexion and 39–41% at post settlement. Snout length equal to eye diameter at 6.0 mm; snout bluntly triangular becoming rounder and relatively shorter (<eye diameter) following settlement. Mouth large and moderately oblique; tip of maxilla reaching to between the anterior margin of the orbit and the pupil at 6.0 mm. Teeth present on upper and lower jaws, including canine teeth present on upper jaw only. Nasal pit unroofed at 6.0 mm. No scales present at 6.0 mm, but the settled individuals are fully scaled.

Spination on head well developed, and spines smooth. The longest head spine, at angle of preopercle, decreases in relative length from 13% at 6.0 mm to 4–5% in the settled individuals. On the outer border of the preopercle, one spine is located above spine at preopercular angle and four on the lower border. In the settled individuals, (16.8 and 17.3 mm) there are 12 small serrations on the outer border, increasing to ca. 17 at 20.3 mm. On the inner, upper preopercle limb, there is 1 small spine at 6.0 mm, and the inner lower limb has 5 small spines. In the settled specimens, spines were absent on the inner limb of the preopercle. Opercle has a single spine. Subopercular spines are absent in the 6.0 mm specimen, however a single, small spine is present in the settled 16.8 mm specimen. Interopercle with a single spine just dorsal to the preopercular angle at 6.0 mm, no interopercle was observed in the settled specimens. The supraorbital ridge has a single, small spine at 6.0 mm and is overgrown in the settled individuals. Two supracleithral spines present. Two dorsal posttemporal spines present in 6.0 mm larvae, and 3 to 5 in the settled individuals. A small postcleithral spine is present.

The 6.0 mm late flexion-stage larva has 10+8 principal caudal rays. All D, A and P2 fin elements are present. P1 fin has 12 ossified plus 2 incipient rays. Fin spines robust and chevron-shaped in cross-section, except P2 spine which has two leading-edge ridges, and is concavely trapezoidal in cross-section. Weak serrations present on the trailing edges of D spines 1 to 7, but not on the leading edge. Dsp 2 trailing edge serrations cover its entire length, the approximate count of serrations was 40, however the spine is slightly damaged. Serrations are present on the 2 leading edge ridges of P2. Each anal-fin spine differs. Spine 1 has serrations on both trailing and leading edges, although the latter is limited to a very few serrations. Spine 2 has serrations on only the trailing edge, whereas spine 3 lacks serrations entirely. All fin-spine serrations are absent in the settled individuals. The Dsp 2 is longest fin spine, 31% SL in the 6.0 mm larva, and is approximately twice the length of Dsp 3 (Fig. 2).

Pigment. The larva is lightly pigmented. The 6.0 mm larva is mostly devoid of external pigment on the body except for three melanophores on the caudal peduncle, 2 are expanded stellate, one at the base of the urostyle and the second below and slightly smaller and posterior to the first. A third, punctuate contracted melanophore is positioned on the ventral midline about midway between the anal and caudal fins. There are three faint and very small contracted punctate melanophores dorsally on the midbrain. Internal pigment forms a large saddle dorsally over the gas bladder to the posterior margin of the gut. The fins of the larva are mostly devoid of pigment except for a series of melanophores on the trailing edge of the chevron groove of Dsp 2, and on the fin membrane between spines II and III. The base of the caudal fin has two melanophores: one on the posterior base of the 5th lower principal ray and a much smaller one on the 3rd upper principal ray. There is no trace of the distinctive post-settlement colour pattern which is illustrated by Kishimoto *et al.* (1987) and Randall (2005).

Remarks. Leis (2007) predicted "based on comparison of recently settled individuals, it is reasonable to expect that pelagic larvae of *M. macularis* will be similar to those of *M. niger*, but possibly somewhat deeper-bodied, and with longer elements in the spiny dorsal and pelvic fins. Probably, *M. macularis* larvae have weak serrations on fin spines similar to those of *M. niger*." Larvae of the two *Macolor* species are similar, and have similar head and fin spination (including serrations) and similar pigmentation, including the distinctive lateral caudal peduncle melanophores. However, the 6.0 mm larva of *M. macularis* is not deeper bodied than larvae

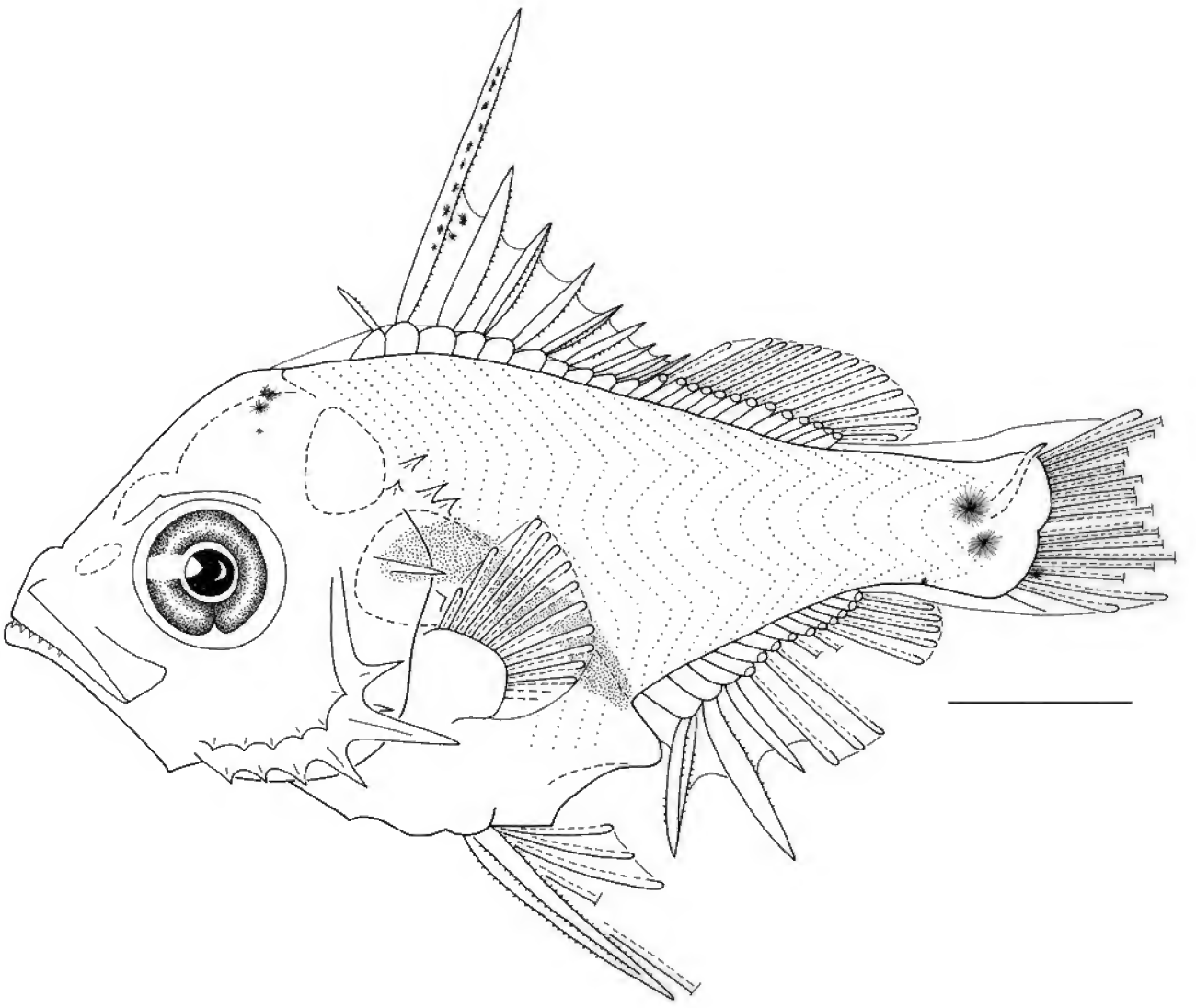

Fig. 1. Larva of *Macolor macularis*, 6 mm SL (NSMT-PL 369) from the southwest Pacific Ocean near the Solomon Islands. Scale bar = 1 mm.

of *M. niger* (BD = 46% vs 47–50% SL, respectively), and although the dorsal spines of *M. macularis* are longer than those of *M. niger* following settlement (Dsp 2 = 38% SL vs 17% SL, respectively) they are not in the larvae (Dsp 2 = 31% SL vs 33–35% SL, respectively). Nor are the pelvic spines of the 6.0 mm *M. macularis* longer than those of *M. niger* (P2 sp = 26% SL, vs 25–31% SL, respectively). One difference in fin spines is the ratio of dorsal-fin spines 2 and 3. At any size, this ratio is greater in *M. macularis* than in *M. niger* (Fig. 1). Interestingly, the differences between the two species in spine length and body depth found following settlement must develop late in the pelagic larval phase. The only notable differences in pigment are the absence in *M. macularis* of melanophores on the opercle near the base of the opercular spine that are present in larvae of *M. niger*, and the series of melanophores in the chevron of dorsal-fin spine 2 in *M. macularis*, which is lacking in *M. niger*.

The rarity of larvae of *Macolor* species in collections is puzzling. Thus far, a total of only three pelagic larvae, and four settlement-stage larvae have been reported, yet the adults are abundant in outer reef habitats. The three reported larvae were found well offshore, not close to reefs or in lagoons.

Table 1. Morphometrics (mm) of the *Macolor macularis* larva. Abbreviations are: PreAL, preanal length; *PreDL*, predorsal-fin length; *HL*, head length; *ED*, eye diameter; *SnL*, snout length; *BD(P)*, body depth at P1 base; *BD(A)*, body depth at anus; *PedL*, caudal peduncle length; *Dsp*, dorsal-fin spine; *P2sp*, pelvic-fin spine.

SL	PreAL	PreDL	HL	ED	SnL	BD(P)	BD(A)	PedL	Dsp 2	Dsp 3	P2sp
6.0	3.7	2.4	2.5	0.7	0.7	2.8	2.1	1.1	1.6	1.0	1.6

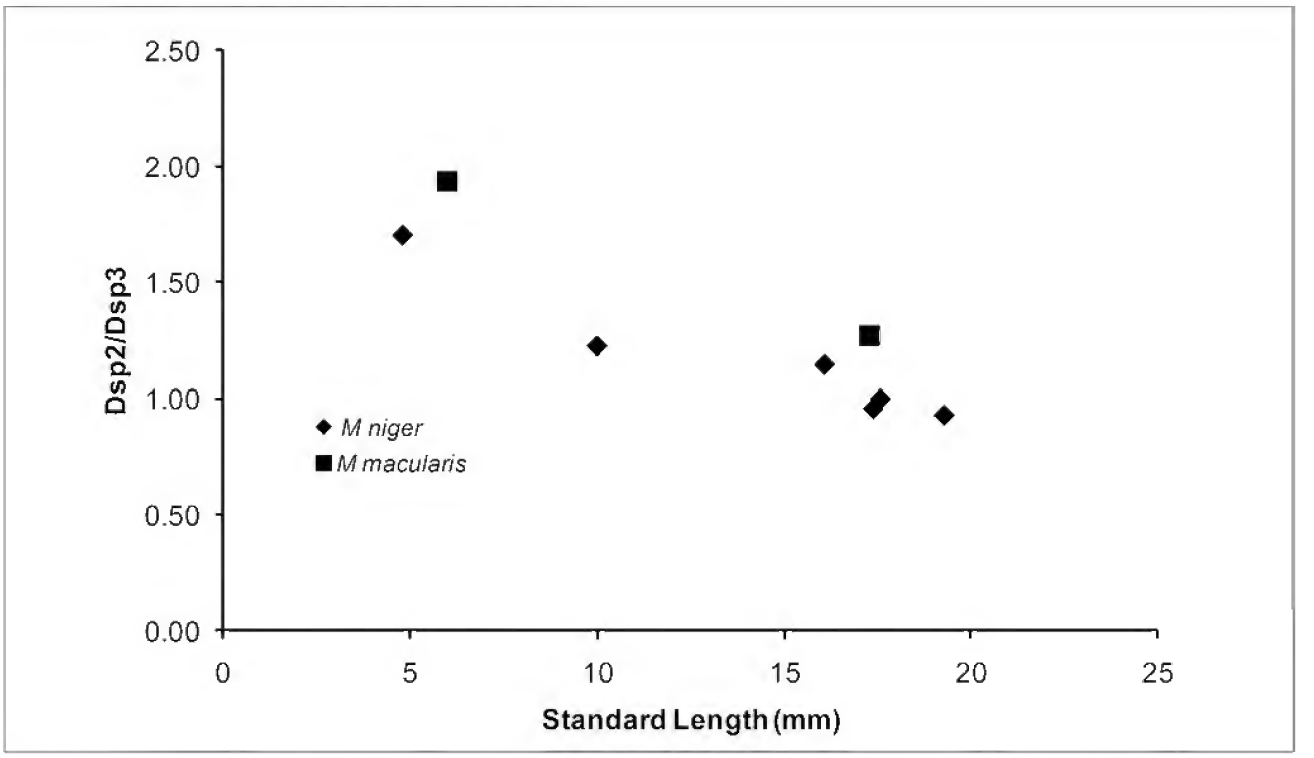

Fig. 2. Relationship between standard length and ratio of length of dorsal-fin spine 2 to that of dorsal-fin spine 3 in larvae and settled individuals of *Macolor macularis* and *M. niger*. Spine length ratio for only one settled *M. macularis* from Leis (2007) is plotted because the other specimens did not have intact second dorsal-fin spines.

In spite of the apparent abundance of adults, the distinctive juveniles are not similarly abundant in reef habitats (pers. obs., JML; J.H. Choat, pers. comm.). One likely explanation is that adults have a long life span, yet post-spawning survival and recruitment may seldom be successful. In fact, *Macolor* species reach ages of 40–50 years on the Great Barrier Reef (J.H. Choat, pers. comm.), supporting this possible explanation. If this is correct, then the species of *Macolor* would be particularly vulnerable to exploitation, and should be managed extremely carefully.

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Revision of the Tribe Microtrachelizini Zimmerman, 1994, from Australia: New Taxa and Records (Insecta: Coleoptera, Brentidae)

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ABSTRACT. The Microtrachelizini from Australia are revised. Four species and one genus are described as new for science (*Araiorrhinus zimmermani* n.sp., *Howeius micropterus* n.gen., n.sp., *Microtrachelizus altostriatus* n.sp. and *M. australicus* n.sp.). One new synonymy is proposed (*M. laevis* Damoiseau, 1987 n. syn. of *M. montrouzieri* Senna, 1903) and two species are recorded as new for Australia (*M. montrouzieri* and *M. occultus* Kleine, 1935, the latter removed from synonymy with *M. bhamoensis* [Senna, 1892]). An identification key and pictures of the habitus are given for the nine Microtrachelizini species presently known from Australia.

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Introduction

Microtrachelizini Zimmerman, 1994 is a tribe (or subtribe) of brentid weevils occurring in the Old World and containing about 70 species distributed over nine genera (Sforzi & Bartolozzi, 2004). Four species are currently known from Australia: *Araiorrhinus howittii* (Pascoe, 1872), *Higonius novenarius* Damoiseau, 1987, *Microtrachelizus laevis* Damoiseau, 1987 and *M. queenslandicus* Damoiseau, 1987. Zimmerman (1994) listed nine Microtrachelizini species for Australia but only three were named (*A. howittii, H. novenarius* and *M. laevis*), while the others were labelled only as *Microtrachelizus* species 2 to 7. Examination of these specimens and of unidentified material from diverse collections allowed the recognition and description of four new species and one new genus, as well as the establishment of one new synonymy and the recording of two additional species for Australia.

Material and methods

Measurements were taken using a Nikon SMZ1000 stereo microscope. Body length was measured from the apex of the rostrum to the apex of the elytra, head length from the apex of the rostrum to the base of the head, pronotal length from apex to base along the midline, pronotal width across the widest part of the pronotum and elytral length from apex to base along the midline. Male and female genitalia were extracted by removing the abdomen of relaxed specimens and boiling it for 10 minutes in hot KOH solution. Male genitalia were glued on the card with the specimen and female genitalia mounted on microscope slides in Euparal« mountant. The latter were shown to be taxonomically and phylogenetically very informative in Curculionoidea (Gaiger & Vanin, 2008). The terminology used for genital segments follows partly Deuve (1994). In the descriptions, the term "metasternum" is used for the posterior ventral part of the metathorax. Other

Key to the species of Australian Microtrachelizini

1 Antenna with nine segments ..... *Higonius novenarius* Damoiseau, 1987
—— Antenna with eleven segments 2

2 Pronotal groove distinct over full length 3
—— Pronotal groove distinct only at base or obsolescent 7

3 Elytral interstria 2 distinct only at apex 4
—— Elytral interstria 2 distinct at least at base and at apex 5

4 Prothorax of male hairy in front of procoxae; parameres not fused at base; temples protruding behind eyes; elytral interstriae shiny ..... *Microtrachelizus occultus* Kleine, 1935
—— Prothorax of male glabrous in front of procoxae; parameres fused at base; temples hardly distinct, not protruding; elytral interstriae dull ..... *Microtrachelizus altostriatus* n.sp.

5 Elytral interstria 4 not reaching base of elytra ..... *Microtrachelizus montrouzieri* Senna, 1903
—— Elytral interstria 4 reaching base of elytra 6

6 Pronotum almost cylindrical; prorostrum long; apex of antennomere 11 acute; styli of gonocoxites apical ..... *Araiorrhinus howittii* (Pascoe, 1872)
—— Pronotum much wider at base than at apex; prorostrum shorter; apex of antennomere 11 not acute; styli of gonocoxites lateral *Microtrachelizus australicus* n.sp.

7 Elytra laterally smooth and shiny ..... *Araiorrhinus zimmermani* n.sp.
—— Elytra laterally not smooth, interstriae more or less distinct 8

8 Elytral interstria 2 distinct only at apex; humeral callus distinct (see habitus photo), hind wings functional; length < 7 mm ..... *Microtrachelizus queenslandicus* Damoiseau, 1987
—— Elytral interstria 2 distinct from base to apex; humeral callus weak (see habitus photo), hind wings reduced; length > 7 mm ..... *Howeius micropterus* n.sp.

terms are defined by Sforzi & Bartolozzi (2004) or are widely used in describing brentid morphology. Only Australian specimens are listed under "Material examined".

Specimens studied here are depsoited in the following meseums:

AMS	Australian Museum, New South Wales, Sydney, Australia.
ANIC	Australian National Insect Collection, Canberra, Australia.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
QMB	Queensland Museum, Brisbane, Australia.
MNHN	Muséum national d'Histoire naturelle, Paris, France.
MSNG	Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy.
MZUF	Museo di Storia Naturale, Sezione di Zoologia "La Specola", Università di Firenze, Italy.
NHM	The Natural History Museum, London, United Kingdom.
SAMA	South Australian Museum, Adelaide, Australia.

Taxonomy

Microtrachelizini Zimmerman

Microtrachelizina Zimmerman, 1994: 182. Type-genus: *Microtrachelizus* Senna, 1893: 315. Microtrachelizini Morrone, 1998: 132.

Distribution. Afrotropical region (including Madagascar), Oriental region from India to Japan, Australian region.

Araiorrhinus Senna

Araiorrhinus Senna, 1893: 325. Type-species: *Araiorrhinus longirostris* Senna, 1893, by subsequent designation (Kleine, 1938).

Diagnosis. Head much broader than long; temples much shorter than length of eyes. Prorostrum lengthened, at least 0.8× longer than head + metarostrum + mesorostrum. Last antennal segment acuminated at apex. Elytra glabrous. Sternite VII of abdomen with two latero-apical depressions. Gonopods IX fused at base, without sclerified lateral tooth. Styli strongly reduced, apical. A more comprehensive diagnosis for this genus is the subject of another work in preparation.

Distribution. Oriental and Australian regions.

Araiorrhinus howittii (Pascoe)

Trachelizus howittii Pascoe, 1872: 320.
Microtrachelizus howitti [sic] (Pascoe): Senna, 1893: 318.
Araiorrhinus howitti [sic] (Pascoe): Damoiseau, 1966: 13.
Araiorrhinus australicus Senna, 1893: 327; Damoiseau, 1987: 66 (syn.).

Material examined. QUEENSLAND: 1 ex., N. Qld., 6 km SW of Kuranda, 6.xi.–10.xii.1984, Storey & Halfpapp (NHM); 1 ex., N. Qld., Windsor Tableland via Mt Carbine. Malaise T., 26.xii.1983–24.i.1984, Storey & Halfpapp (NHM); 1 ex., N. Qld., Wongabel S.F., 6 km S of Atherton, 9.i.–10. ii.1984, Storey & Brown (NHM); 1 ex., Whitfield, Cairns, N. Q., 2100', 27.x.71, at light (MNHN); 1 ex., 26 km up Tinaroo Ck Rd via Mareeba, N. Qld., 23.xii.1982–12.i.1983, Morgan, Brown & Storey (NHM); 1 ex., Kuranda, N. Q., Black Mtn Rd, 11 miles N, 6 Nov 1975, A. & M. Walford-Huggins (NHM); 1 ex., Binna Burra, QLD, Lamington Nat. Pk, 25 Mar.–4 Apr. 1985, J. & N. Lawrence, surfaces at night (ANIC); 2 ex., Bunya Mts, Q., 26°50'S 151°33'E, 5 km from summit on Kingaroy Rd, 6.i.70, under bark of decaying log., E. B. Britton (ANIC and MNHN); 1 ex., 15°47'S 145°14'E, Shiptons Flat, QLD, 17–19 Oct. 1980, T. Weir (ANIC); 1 ex., 28°14'S 153°08'E, Lamington N. P., (O'Reillys), Q., 2–4 March 1980, J. F. Lawrence, lot 80–26, *Ganoderma applanatum* (ANIC); 1 ex., 15°04'S 145°09'E, QLD, 3 km E of Mt Webb, 30 Apr–2 May 1981, A. A. Calder, collected at light (ANIC); 2 ex., Brisbane (ANIC); 1 ex., Tully R. Xing, 10 km S Koombooloomba Dam, N. Qld, 8 Dec 1989–4 Jan 1990, 750 m, Monteith, Thompson & Janetski, pitfall and intercept traps (QMB); 1 ex., Mossman Bluff Track, 4–10 km W Mossman, N. Qld, 20 Dec 1989–15 Jan 1990, 600 m, Monteith, Thompson & Anzses, site 4, flt intercept (QMB); 1 ex., Mt Father Clancy, 9 km S Millaa Millaa, N. Qld, 6 Dec 1988, 950 m, Monteith & Thompson, *Pyrethrum*/logs and trees (QMB); 1 ex., Windsor Tableland, N. Qld, 27 Dec 1988–8 Jan 1989, E. Schmidt & Anzses, site 6, flt. intercept (QMB); 1 ex., NEQ: 17°28'S 145°32'E, Kenny Road, 25 Nov 1994–10 Jan 1995, 850 m, Monteith & Hasenpusch, flt. intercept (QMB); 1 ex., NEQ: Lake Eacham, 750 m, 9 Dec 1989–14 Jan 1990, Monteith, Thompson & Janetzki, pitfall and intercept (QMB); 1 ex., NEQ: 17°22'S 145°42'E, Lamins Hill, 1 Dec 1993–25 Feb 1994, 880 m, Monteith & Hasenpusch, RF Pitfalls (QMB); Coorumba, 10.XII.1975, QLD (AMS).

NEW SOUTH WALES: 1 ex., N.S. Wales, A. M. Lea 1909 (MSNG); 1 ex., N. Galles (MNHN); lectotype *A. australicus*, New S Wales, Australia, don. Dr Faust (MZUF); 1 ex., N.S.W., Bar Mountain, Border Ranges N.P., 17.II.2005, leg. R. de Keyzer (HNHM); 1 ex., N.S.W., 37°04'30"S 148°28'00"E, 4 km NE Mt Wog Wog, 17 km SE Bombala, Jul. 1996, leg. C.R. Margules (HNHM); N.S.W., 4 km NE Wog Wog, 17 km SE Bombala, 37°04'30"S 148°28'00"E, pit trap, Apr. 1997, leg. Milkovits (HNHM); 1 ex., New England Nat. Park, 12.x.66, E. Britton (ANIC); 1 ex., 35°16'S 149°06'E, Black Mtn Reserve, 15 Mar 1985, Z. Liepa coll. (ANIC); 1 ex., Malaise trap, Black Mtn, Mar.1982, I. D. Naumann & J. C. Cardale (ANIC); 1 ex., North Canberra, 28 Mar 1985, K. R. Pullen (ANIC); 1 ex., Black Mt., 25 Nov 1979, J. F. Lawrence, Lot 79–43, rotten base of *E. mannifera* (ANIC); 1 ex., 28°22'S 153°05'E, Wiangaree S. F., NSW, 1050 m, 10–12 Feb. 1983, T. Weir & A. Calder, surfaces at night (ANIC); 1 ex., Black Mt A. C. T., light trap, 30.iii.68, M. S. Upton (ANIC); 2 ex., "Lorien" W. R. 3 km N Lansdowne/Taree, NSW, 3–10 Jan 1988, G. Williams, malaise trap (ANIC and MNHN); 1 ex., 32°07'S 151°29'E, NSW, Allyn Riv. For. Park, White Rock campsite, 5 Apr. 1993, C. Reid, beating rainforest vegetation (ANIC); 1 ex., Lilyvale, New South Wales, 4.1972, R. H. Mulder (ANIC); 4 ex., Neilson Pk, NSW, XII.1930, K. K. Spence (AMS); NSW, Brindle Ck Rd, 2.5 km N of Brindle Ck, 28°22'S 153°04'E, Border Range NP, 965 m (NPWS Survey), 4.II.-9.IV.1993, M. Gray, G. Cassis (AMS);

LORD HOWE ISLAND (NSW):1 ex., NSW, Southern face of Mt Lidgberg, at base of summit tabletop, Lord Howe Is., 31°34'37"S 159°05'04"E, 26.XI–03. XII.2000, pit trap (MNHN); 1 ex., NSW, cnr Lagoon Rd & Middle Bay Rd, 31°31'47"S 159°03'56"E, 15.II.2001, M. S. Moulds, passive sampling (AMS); NSW, Research Station backyard, Lord Howe Island, 31°31'37"S 159°03'58"E, 24.II.2002, M. S. Moulds, passive sampling (AMS); NSW, Lord Howe Island, Stephens Reserve, c 10 m, 31°31'33"S 159°03'53"E, 29.XI.2000, beating, C. Reid (AMS).

Habitus. Fig. 9.

Distribution. This species is endemic to Australia, apparently common in Queensland, New South Wales and Lord Howe Island.

Araiorrhinus zimmermani n.sp.

Microtrachelizus species 2, Zimmerman, 1991: 151; 1994: 192, 193, 194.

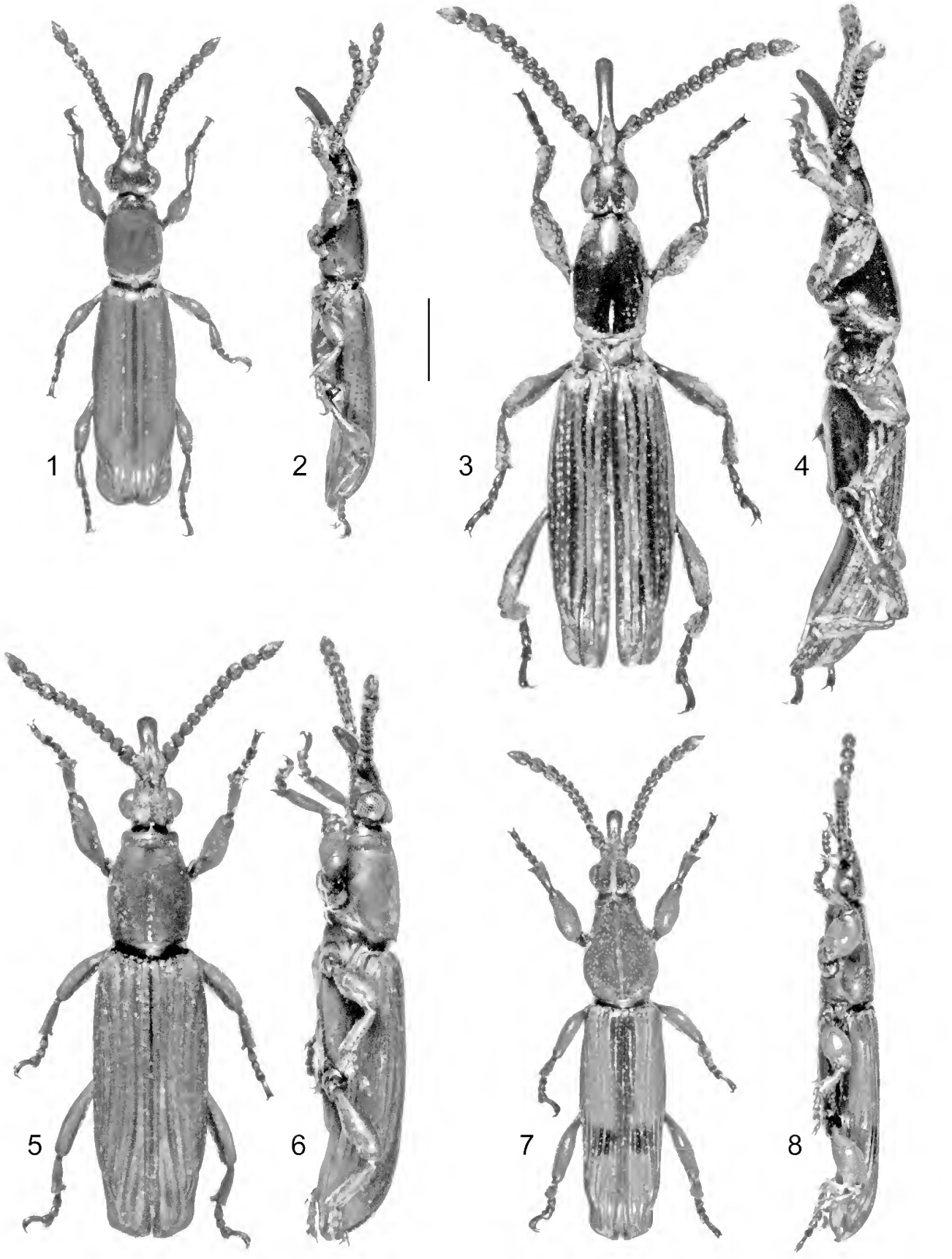
Type material. HOLOTYPE ♀, Mt Glorious, 4.I.1974, R. A. Yule, associated with *Eurhamphus fasciculatus* in Hoop Pine (ANIC). PARATYPES: ♀, Mt Glorious, 16.V.1974, R. A. Yule, MNHN EC1816 (MNHN); ♂, E. Sutton, 20.7.32, Rivertree (ANIC).

Description. Measurements. Length: 5.1–5.6 mm; width across humeral calli: 0.7–0.9 mm; ratios: length of head/length of pronotum: 1.3–1.4; length of pronotum/width of pronotum: 1.4–1.5; base of pronotum/apex of pronotum: 1.1–1.2; length of pronotum/length of elytra: 0.38–0.40; length of elytra/width of elytra: 3.3–3.9. —*Colour*. Brownish-red. — *Habitus*: Figs 1–2. — *Head* (Fig. 14) strongly broader than long, convex, smooth, shiny, without basal notch. Eyes large, projecting laterally; temples very short, almost indistinct, not protruding behind eyes. Vertex and frons smooth. Metarostrum and mesorostrum with broad, deep median groove vanishing on basal half of prorostrum; metarostrum without lateral grooves. Prorostrum 1.0–1.3× longer than head + metarostrum + mesorostrum. Antennal segment 3 (Fig. 15) conical, hardly longer than broad; 4–8 almost cylindrical, broader than long; 9–11 not flattened, forming a club, 11th 1.7–1.9× longer than 10th, strongly acuminate at apex. Venter of head and metarostrum longitudinally grooved; mesorostrum with a weak projection on either side under antennal base; lower side of mesorostrum and base of prorostrum with few erect setae. —*Pronotum* (Fig. 14) cylindrical, shiny, smooth, without longitudinal groove except at base. Prothorax without fovea in front of strongly bulging and conical procoxae; prosternellum distinct, depressed. Meso- and metafemora pedunculate. Protibiae (Fig. 16) 0.7–0.8× as long as profemora. Metasternum convex, not grooved, smooth, laterally not carinate. Elytra glabrous, base straight; sides smooth and shiny; apex strongly rimmed, not notched. Interstria 2 distinct only at apex; 3 distinct at base and apex, very narrow in middle; 4 hardly distinct from base to apical declivity; 5–9 indistinct. Hind wings without basal sclerite (Fig. 50). — *Abdomen*. Sternites III–IV in female (Fig. 17) smooth, depressed in middle, laterally not carinate; V–VI smooth; VII with weak transverse basal notch and two large, deep latero-apical depressions, without apical fovea. Tergite VIII of female (Fig. 18) strongly denticulate at apex. Spermatheca as in Fig. 19. Gonocoxites (Fig. 20) fused at base; styli apical, reduced. Sternites III–IV in male more depressed; V–VII as in female. Spiculum gastrale as in Fig. 21. Tegmen (Fig. 22) with parameres short, reduced, filiform, not fused.

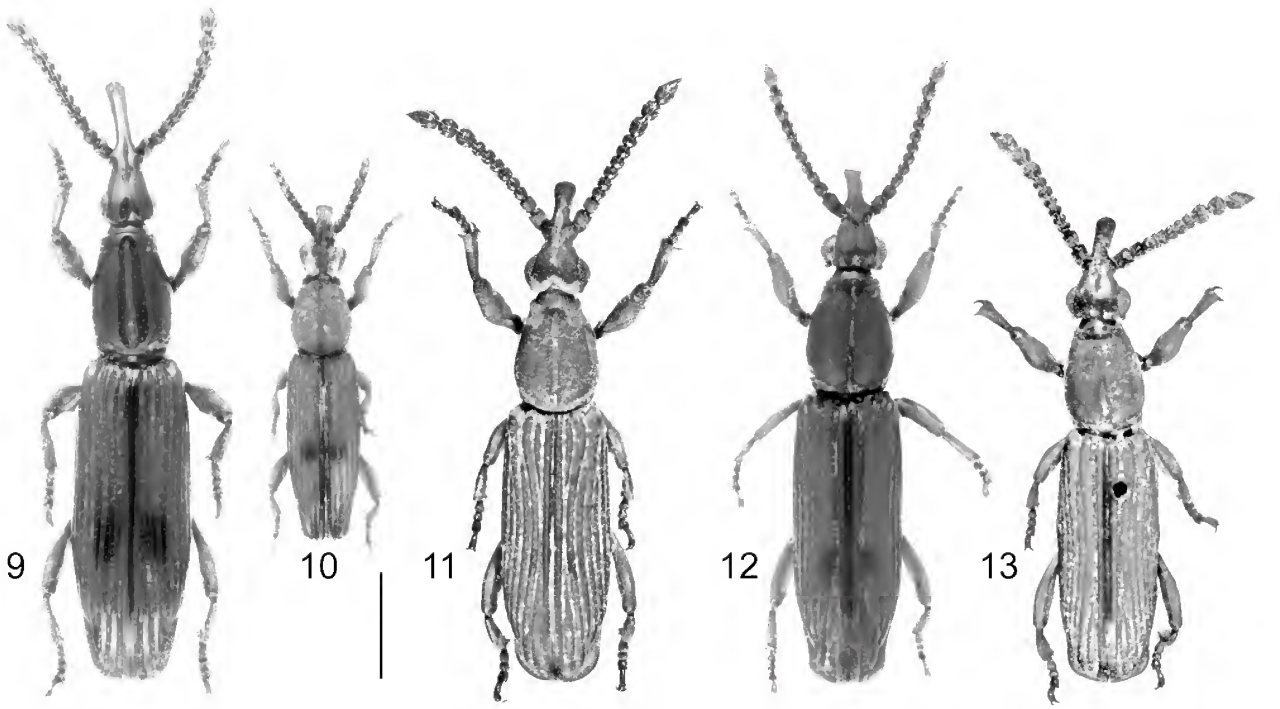
Distribution. Known from southern Queensland (Mount Glorious) and northern New South Wales (Rivertree).

Etymology. This new species is kindly dedicated to Elwood C. Zimmerman, in recognition of his great work on the Australian Curculionoidea.

Remarks. This new species was regarded by Zimmerman (1991: 151; 1994: 192–194) as belonging to the genus *Microtrachelizus*, but its apically inserted styli and long prorostrum (longer than head + metarostrum + mesorostrum) indicate that it belongs in *Araiorrhinus* instead. This is the second species of *Araiorrhinus* known from Australia. In the identification key of Damoiseau (1987) for this genus, the new species runs to *A. longirostris* Senna, 1893 (a synonym of *A. exportatus* Senna, 1893: see Mantilleri, 2007) and *A. levisulcatus* Damoiseau, 1987, but it differs from all *Araiorrhinus* species in its completely smooth elytra.



Figs 1–8. Dorsal and lateral habitus of new species of Australian Microtrachelizini, holotypes. *(1–2) Araiorrhinus zimmermani* n.sp., ♀. (3–4) *Howeius micropterus* n.gen., n.sp., ♂. *(5–6) Microtrachelizus altostriatus* n.sp., ♂. *(7–8) Microtrachelizus australicus* n.sp., ♂. Scale 1 mm.



Figs 9–13. Dorsal habitus of Australian Microtrachelizini. *(9) Araiorrhinus howittii* (Pascoe, 1872). *(10) Higonius novenarius* Damoiseau, 1987. *(11) Microtrachelizus montrouzieri* Senna, 1903. *(12) M. occultus* Kleine, 1935. *(13) M. queenslandicus* Damoiseau, 1987. Scale 1 mm.

Higonius Lewis

Higonius Lewis, 1883: 299. Type species: *Higonius poweri* Lewis, 1883: 299, by subsequent designation (Kleine, 1938).

Diagnosis. Head broader than long, notched at base, bilobed above neck; temples shorter than length of eyes. Vertex, frons and metarostrum grooved. Mesorostrum strongly raised, forming a kind of plate above antennal insertion. Prorostrum much shorter than head + metarostrum + mesorostrum. Last three antennal segments flattened. Pronotum longitudinally grooved. Interstria 8 forming the external apical border of elytra. Hind wings with strongly sclerified basal sclerite. Sternites V–VI with three basal notches; sternite VII with two latero-apical depressions. Gonopods IX fused at base, with sclerified lateral tooth. Styli strongly reduced, lateral.

Distribution. Oriental and Australian region.

Higonius (Higonodes) novenarius Damoiseau

Higonius novenarius Damoiseau, 1987: 48.
Higonodes novenarius (Damoiseau): Zimmerman, 1994: 188.
Higonius (Higonodes) novenarius Damoiseau: Mantilleri, 2009.

Habitus. Fig. 10.

As a result of a phylogenetical analysis (Mantilleri, 2009), the genus *Higonodes* Zimmerman, 1994 was downgraded to the rank of a subgenus of *Higonius*. Indeed, characters cited to support the creation of the monotypic genus *Higonodes* are mainly autapomorphic, without phylogenetic implications. No specimens from Australia could be examined, but the good illustrations in Zimmerman (1994: 185–187) leave no doubt about the occurrence of this species in this country. It also occurs in New Guinea.

Howeius n.gen.

Lord Howe Genus A, Zimmerman, 1991: 157; 1994: 215.

Type species. *Howeius micropterus* n.sp.

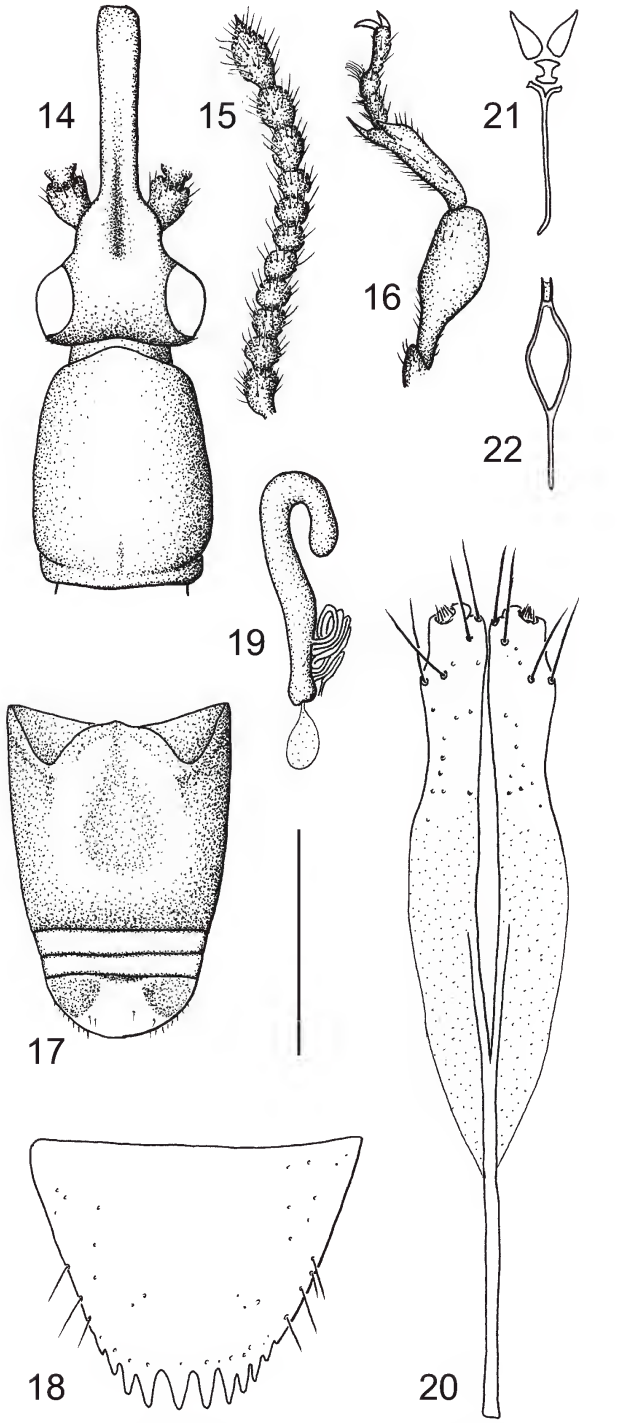
Diagnosis. Prorostrum longer than 0.5× the length of head + metarostrum + mesorostrum; mesorostrum with a small projection on either side under antennal base. Metasternum and sternites III–IV laterally not carinate. Sternites V–VI smooth, without basal notch; VII with two latero-apical depressions and no basal notch or apical fovea. Gonocoxites (Fig. 33) fused at base; apex with a strong sclerotized lateral tooth; styli apical, reduced.

Remarks. The characters given in the diagnosis of the genus are not repeated in the description of the new species below.

Howeius micropterus n.sp.

Type material. HOLOTYPE ♂, Aust: NSW, Lord Howe Island, S. & J. Peck, 17–31.V.1980, Transit Hill, 350', pan traps, lowland tall forest (ANIC). PARATYPES: ♀, NSW, Steven's Reserve Disturbance Gradients, Lord Howe Is., 31°31'25"S 159°04'06"E, 08–15.XII.2000, H. Gibb, R. Harris & T. Moulds, LHI/SR/30/2/1 (pit trap), K192981, prép. micro. no. AM00113, MNHN EC1813 (MNHN); ♀, NSW, Lord Howe Island, Mt Gower, leaf litter, 31°35'S 159°04'E, 100 m, 01.XI.1978, T. Kingston, K188532 (AMS); ♂, NSW, Mt Lidgbird, SE end in dip between "Pimple" and main cliff, 31°34'18"S 159°05'00"E, 21.V.2001, Ian Hutton, leaf litter ex. leaf litter caught in birds nest fern *Asplenium goudeyi*, 15 m off ground, K188534 (AMS); ♂, NSW, Mt Gower, Lord Howe Island, Midway down gully near igloo, 31°35'06"S 159°04'32"E, ca 782 m, 18–31.I.2002, I. Hutton, MG002 (pit trap), K185284 (AMS); ♂, NSW, in forest behind research station, Lord Howe Island, 31°31'37"S 159°03'58"E, 22.II.2001, Jaynia Tarnawski, LHI/JT/08L, leaf litter ex palm and banyan litter, K188533, MNHN EC1814 (MNHN).

Description. Measurements. Length: 7.6–10.3 mm; width across humeral calli: 0.93–1.40 mm; ratios: length of head + rostrum/length of pronotum: 1.2–1.4; length of pronotum/



Figs 14–22. *Araiorrhinus zimmermani* n.sp. (14) Head and pronotum, dorsal view. (15) Antenna. (16) Left front leg. (17) Abdomen of female, ventral view. (18) Tergite VIII of female. (19) Gonocoxites. (20) Spermatheca. (21) Spiculum gastrale. (22) Tegmen. Scale for Figs 14–17 and 21–22, 1 mm; scale for Figs 18–19, 0.35 mm; scale for Fig. 20, 0.17 mm.

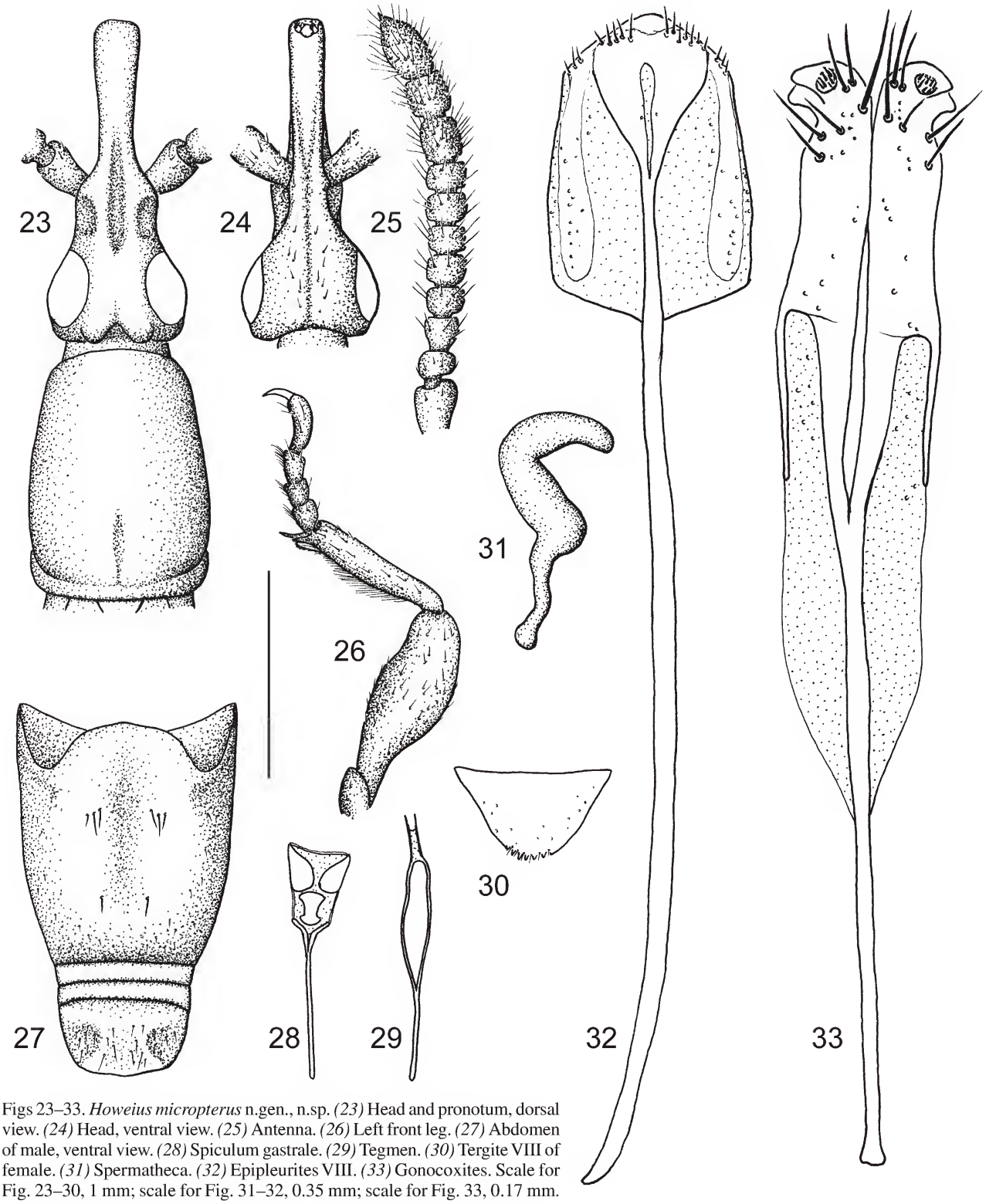
width of pronotum: 1.5–2.0; base of pronotum/apex of pronotum: 1.1–1.4; length of pronotum/length of elytra: 0.45–0.55; length of elytra/width of elytra: 2.6–3.0; length of protibia/width of protibia: 4.8–5.3. — *Colour*. Brownish-red to dark brown. — *Habitus*: Figs 3–4. — *Head* (Fig. 23) broader than long, quite convex, smooth, with a deep median notch at the base. Eyes large but not projecting laterally; temples very short, not protruding behind eyes. Vertex and frons smooth. Metarostrum and mesorostrum strongly grooved longitudinally, the groove reaching base of prorostrum; metarostrum with well-marked lateral grooves. Prorostrum smooth, 0.8–1.1× as long as head + metarostrum + mesorostrum. Antennal segment 3 (Fig. 25) conical, 4–8 cylindrical with a row of long raised setae; 9–11 not flattened, forming a club, 11th 1.7–1.8× longer than 10th, acuminated at apex. Venter of head tomentous, metarostrum and mesorostrum and basal half of prorostrum with a longitudinal groove (Fig. 24). — *Pronotum* cylindrical (Fig. 23), smooth, shiny, grooved only on basal third. Prothorax slightly depressed in front of procoxae; prosternellum hardly distinct. Procoxae bulging, strongly conical. Legs punctate; all femora with yellowish setae on underside (especially in male); meso- and metafemora pedunculate. Protibiae (Fig. 26) 0.8× as long as profemora. Metasternum quite convex, smooth, not grooved. Elytra glabrous, almost completely fused together, the base slightly concave with weak humeral callus. Interstria 2 present almost from base to apex; 3 strongly elevated at base, then more depressed but still distinct, elevated at apex; interstria 4 present from base to apical declivity; 5–6 hardly distinct; 7 more elevated; 8 as 5 and 6; 9 as 7 and forming the external apical border of elytra. Apex of elytra not rimmed nor notched. Mesonotum triangular, its apex pointing upwards. Metanotum weakly sclerotized. Hind wings reduced to small membranous strips.

Sternites III–IV in male (Fig. 27) almost smooth, with few fine punctures and a median longitudinal depression; three large setae on each side of sternite III and one large setae on each side of sternite IV. Spiculum gastrale as in Fig. 23. Tegmen (Fig. 29) with parameres reduced and filiform, not completely fused. Sternites III–IV in female similar to male, longitudinal depression on sternite III weaker and large setae missing. Tergite VIII denticulate at apex (Fig. 30). Spermatheca as in Fig. 31. Epipleurites VIII as in Fig. 32.

Distribution. Recorded only from Lord Howe Island and probably endemic there as its elytra are almost completely fused and its hind wings are not functional.

Etymology. The generic name derives from Lord Howe Island and is masculine in gender, and the specific epithet describes the strong reduction of the hind wings.

Remarks. This new taxon was figured by Zimmerman (1991: 157) under the name Lord Howe Genus A, and listed in his subtribe Trachelizina. However, it belongs to Microtrachelizini as indicated by the structure of the ventral side of the mesorostrum (presence of two small projections under the antennal insertions), the third protarsal segment not being bilobed, sternite VII having two latero-apical depressions, the tegmen being ring-shaped with filiform parameres and the gonocoxites of female fused at based, with reduced styli. Its placement in Microtrachelizini is not clear: its elongated prorostrum



Figs 23–33. *Howeius micropterus* n.gen., n.sp. *(23)* Head and pronotum, dorsal view. *(24)* Head, ventral view. *(25)* Antenna. *(26)* Left front leg. *(27)* Abdomen of male, ventral view. *(28)* Spiculum gastrale. *(29)* Tegmen. *(30)* Tergite VIII of female. *(31)* Spermatheca. *(32)* Epipleurites VIII. *(33)* Gonocoxites. Scale for Fig. 23–30, 1 mm; scale for Fig. 31–32, 0.35 mm; scale for Fig. 33, 0.17 mm.

places it near *Araiorrhinus* but its elytral venation, apex of elytra and structure of gonocoxites differ strongly from the conditions in *Araiorrhinus* where there is no strong sclerotization of the apex of gonocoxites (see Fig. 20 for comparison with *A. zimmermani* and Fig. 49 for comparison with representative of the genus *Microtrachelizus*). This new taxon seems to occupy an intermediate position between *Araiorrhinus* and *Microtrachelizus* and does not fit with any of the known genera of the tribe. It represents probably a quite old lineage but its presence on Lord Howe Island is surprising as this island is only 6.9 million years old (McDougall *et al.*, 1981), but exemples exist in other groups of Arthropoda, e. g. in Insecta Hemiptera with the endemic genus *Howeria* Evans, 1959 (Burckhardt, 2009) or in Araneae Micropholcommatidae Hickman, 1943 with the endemic monotypic tribe Patelliellini (Rix & Harvey, 2010).

Being an oceanic island, it is very possible that this species derives from a migrant to Lord Howe Island and that the sister-species of *H. micropterus* still waits to be discovered, probably on the Australian mainland or in New Guinea. Loss of the hind wings in such a short time (less than 6.9 My) is not surprising; it is well documented for other groups of beetles on similar or even shorter periods (Boucher, 2006).

Microtrachelizus Senna

Microtrachelizus Senna, 1893: 315. Type-species: *Trachelizus lyratus* Perroud & Montrouzier, 1865, by subsequent designation (Kleine, 1938).

Diagnosis. Head without cephalic lobes above neck. Prorostrum shorter than 0.8× head + metarostrum + mesorostrum. Mesorostrum not strongly raised. Sternite VII of abdomen with two latero-apical depressions. Gonopods IX with sclerified lateral tooth. Styli strongly reduced, lateral. A more comprehensive diagnosis for this genus is the subject of another work in preparation.

Distribution. Afrotropical region (including Madagascar), Oriental region from India to Japan, Australian region.

Microtrachelizus altostriatus n.sp.

Microtrachelizus species 4, Zimmerman, 1991: 151; 1994: 195.

Type material. HOLOTYPE ♂, Cape York Pen., N. Q., Iron Range, 15 Sept. 1974, Coll. A. & M. Walford-Huggins (ANIC). PARATYPE ♂, 12°44'S 143°16'E, 6 km ENE of Mt. Tozer, QLD, 30 June 1986, T. Weir & A. Calder, collected at light, MNHN EC1817 (MNHN).

Description. Measurements. Length: 6.3–6.5 mm; width across humeral calli: 1.0–1.1 mm; ratios: length of head/length of pronotum: 0.9–1.0; length of pronotum/width of pronotum: 1.3; base of pronotum/apex of pronotum: 1.3–1.4; length of pronotum/length of elytra: 0.4; length of elytra/width of elytra: 3.3. — *Colour*. Brownish-red. — *Habitus*. Figs 5–6. — *Head* (Fig. 34) broader than long, smooth, with three strong basal notches. Eyes large, projecting laterally; temples indistinct. Vertex and frons not grooved. Metarostrum and mesorostrum strongly grooved, the groove vanishing on prorostrum; metarostrum with deep lateral grooves. Prorostrum 0.5× as long as head + metarostrum + mesorostrum. Antennal segment 3 (Fig. 35) broader than long, conical; 4–8 broader than long, cylindrical; 9–10 not flattened, 11th 1.7–1.8× longer than 10th and acuminate at apex. Venter of head and metarostrum grooved; mesorostrum with a small projection on either side under antennal base. — *Pronotum* (Fig. 34) without punctures, longitudinally grooved. Prothorax with a small fovea in front of procoxae; prosternellum almost indistinct. Protibiae (Fig. 36) 1.40–1.45× longer than profemora. Metasternum flat, grooved, laterally carinate, not punctate. Meta- and mesofemora not pedunculate; inner spur of meso- and metatibia enlarged in male, not bifid. Elytra glabrous, base slightly concave; interstriae elevated. Interstria 2 distinct only at apex; 3 present from base to apex; 4 reaching apical declivity; 5, 6 and 7 fused anteriorly to form a common humeral callus. Apex of elytra rimmed, external apical border formed by interstria 9. Hind wings (Fig. 40) with basal sclerite.

Sternites III–IV in male (Fig. 37) depressed, very slightly carinate on sides before lateral declivities; V–VI each with three basal notches in middle; VII in middle with deep basal notch and apical fovea, latero-apically with two depressions. Spiculum gastrale as in Fig. 38. Tegmen (Fig. 39) with parameres fused at base.

Female unknown.

Distribution. Only known from Queensland, Australia.

Etymology. The specific epithet derives from the Latin words "*altus*", meaning deep, and "*striatus*", meaning striated, referring to the well-marked elytral striae of the species.

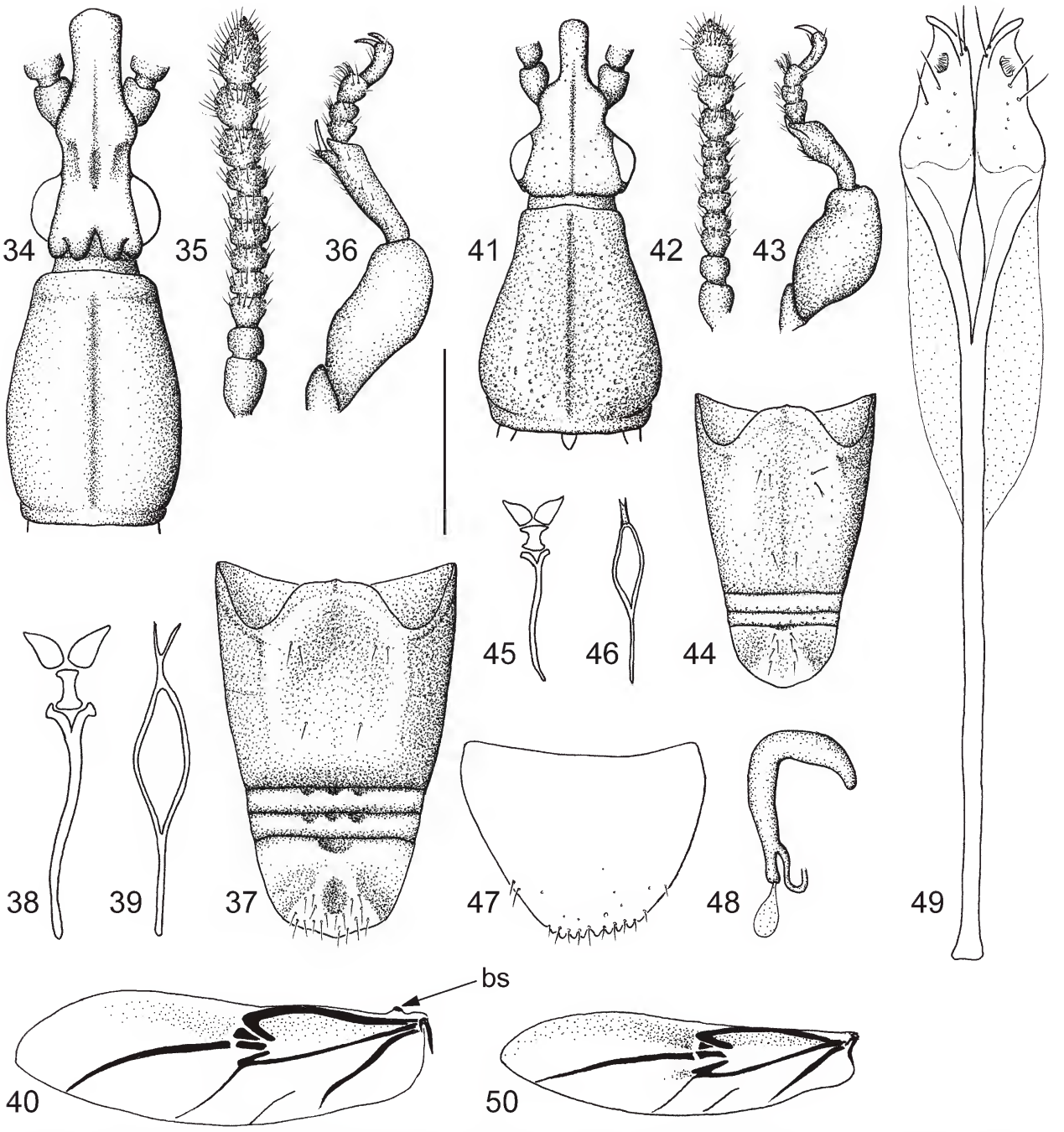
Remarks. This species is probably related to the Oriental species *M. bhamoensis* (Senna, 1892) and *M. cylindricornis* (Power, 1880), which also have the parameres fused at the base, but it differs from the former in having more strongly elevated interstriae and a less strongly rounded elytral apex and from the latter in having elytral interstria 2 distinct posteriorly (obsolete in *H. cylindricornis*).

Microtrachelizus australicus n.sp.

Microtrachelizus species 6, Zimmerman, 1991: 153; 1994: 195.

Type material. HOLOTYPE ♂, QLD. AUST., Cairns, 11 Oct 71, Whitfield R., 11 miles [along road], Collr A. & M. Walford-Huggins (ANIC). PARATYPES: 1♂, Whitfield R., Cairns N. Q., 1350', 16.II.71, J. G. Brooks, MNHN EC1821 (MNHN); 1♀, Whitfield, Cairns N. Q., 1100', 14.XII.70, J. G. Brooks (ANIC); 1♀, Australia: n. Qld, Windsor Tableland, 38 km from main road, 15.I.–8.III.1986, Storey & Brown, MDPI intercept trap site no. 14C (ANIC); 1♂, Australia, Cairns, Qld, Nov. 1947, J. G. Brooks, E. Gowing-Scopes collection (NHM); 1♂, Australia, N. QLD, Millaa Millaa Falls, 4.I.–7.II.1990, Storey & Halfpapp, MDPI F.I.T. site 34, E. Gowing-Scopes collection (NHM); 1♀, Kuranda, N. Q., 8.3.69, J. G. B., prép. micro. no. AM00086, MNHN EC1818 (MNHN).

Description. Measurements. Length: 4.4–5.4 mm; width across humeral calli: 0.7–0.9 mm; ratios: length of head/length of pronotum: 0.7–0.9; length of pronotum/width of pronotum: 1.3–1.4; base of pronotum/apex of pronotum: 1.4–1.6; length of pronotum/length of elytra: 0.40–0.45; length of elytra/width of elytra: 3.1–3.3. — *Colour*. Head, antennae and pronotum brownish-red; legs and elytra paler. Elytra with darker sutural stripe and transverse post-median blotch. — *Habitus*. Figs 7–8. — *Head* (Fig. 41) strongly broader than long, finely punctate, with small basal median notch. Eyes large, projecting laterally; temples short not protruding behind eyes. Vertex and frons shallowly grooved. Metarostrum, mesorostrum and base of prorostrum longitudinally grooved, metarostrum without lateral grooves. Prorostrum with very fine punctures, 0.5–0.7× as long as head + metarostrum + mesorostrum. Antennal segment 3 (Fig. 42) broader than long, conical; 4–8 subglobular, broader than long, with a row of long raised setae; 9–11 slightly flattened, 11th 1.6–2.0× longer than 10th. Venter of head, metarostrum and mesorostrum longitudinally grooved; mesorostrum with small projection on either side under antennal base. — *Pronotum* (Fig. 41) flattened, almost depressed on disc, longitudinally grooved, much broader at base than at apex, with numerous fine punctures. Prothorax without fovea in front of quite rounded, hardly conical procoxae; prosternellum distinct. Protibiae (Fig. 43) 0.5–0.6× as long as profemora. Metasternum longitudinally grooved, laterally not carinate, punctate (especially on lateral declivities). Elytra glabrous, base straight. Interstria 2 present from base to apex; 3 more elevated and present from base to apex; 4 present from base to apical declivity; 5, 6 and 7 fused anteriorly to form



Figs 34–50. *(34–40) Microtrachelizus altostriatus* n.sp.: *(34)* Head and pronotum, dorsal view. *(35)* Antenna. *(36)* Left front leg. *(37)* Abdomen of male, ventral view. *(38)* Spiculum gastrale. *(39)* Tegmen. *(40)* Hind wing (*bs*, basal sclerite). *(41–50) Microtrachelizus australicus* n.sp.: *(41)* Head and pronotum, dorsal view. *(42)* Antenna. *(43)* Left front leg. *(44)* Abdomen of male, ventral view. *(45)* Spiculum gastrale. *(46)* Tegmen. *(47)* Tergite VIII of female. *(48)* Spermatheca. *(49)* Gonocoxites. *(50)* Hind wing. Scale for Figs 34–39 and 38–46, 1 mm; scale for Figs 40 and 50, 2.5 mm; scale for Figs 47–48, 0.35 mm; Fig. 49: 0.17 mm.

a common humeral callus; 8 present only on 2nd half of elytra; 9 forming external apical border of elytra. Apex of elytra not explanate nor notched at apex. Hind wings (Fig. 50) without basal sclerite.

Sternites III–IV (Fig. 44) slightly grooved and punctate, laterally not carinate, weakly depressed in male; V–VI finely punctate posteriorly; VII with transverse median notch at base and two latero-apical depressions, without apical fovea, in male with two rows of raised setae between latero-apical depressions. Spiculum gastrale as in Fig. 45. Tegmen (Fig. 46) with parameres reduced, filiform, short, not fused. Tergite VIII of female (Fig. 47) bluntly denticulate at apex. Spermatheca as in Fig. 48. Gonocoxites (Fig. 49) fused at base; styli reduced, lateral.

Distribution. Only known from North Queensland, Australia.

Remarks. This species cannot be confused with any other of the genus, but its affinities are still unclear.

Microtrachelizus montrouzieri Senna

Microtrachelizus montrouzieri Senna, 1903: 167.
Microtrachelizus laevis Damoiseau, 1987: 56, **new synonym**.

Material examined. Holotype *M. laevis*, Mackay (SAMA); 1 ex., Australia, Cairns, Qld., Nov. 1947, J.G. Brooks (MNHN); 1 ex., Boar Pkt., N.Q. (NHM); 1 ex., Whitfield, Cairns, N.Q., 2100', 27.x.71, at light (NHM); 1 ex., Mt Formartine South, 10 km N Kuranda, N. Qld, 23 Nov. 1990, 700 m, Monteith & Thompson, *Pyrethrum* trees and logs (QMB); 1 ex., *Argyrodendron actinophyllum* Edlin, subtropical rainforest, 27.2–6.3.86, Mt Glorious State Forest, Qld, Y. Basset (ANIC).

Habitus. Fig. 11.

Comparison of the holotypes of *M. montrouzieri* and *M. laevis* revealed that these two names refer to the same species, and they are therefore here synonymized. This species also occurs in Indonesia (Sforzi & Bartolozzi, 2004).

Microtrachelizus occultus Kleine

Microtrachelizus occultus Kleine, 1935: 307.
Microtrachelizus species 5, Zimmerman, 1991: 151; 1994: 195.

Material examined. 1♀, Iron Ra., N. Q., 11.5.71, J. G. Brooks, at light (ANIC); 1♀, 12°43'S 143°17'E, 9 km ENE of Mt Tozer, QLD, 5–10 July 1986, T. Weir & A. Calder, collected at light (ANIC); 1♂, Iron Range, Cape York Pen., N. Qld, 16–23. xi.1965, G. Monteith (QMB).

Habitus. Fig. 12.

This species was described from New Guinea by Kleine (1935) and is here recorded from Australia for the first time. It was synonymized with *M. bhamoensis* (Senna, 1892) by Damoiseau (1987) and also so treated by Sforzi & Bartolozzi (2004). However, it is clearly different from *M. bhamoensis* in having the parameres not fused at the base and the prothorax hairy in front of the procoxae in males (glabrous in *M. bhamoensis*). *Microtrachelizus bhamoensis* is an Oriental species that does not extend in its distribution eastwards to New Guinea.

Microtrachelizus queenslandicus Damoiseau

Microtrachelizus queenslandicus Damoiseau, 1987: 56.
Microtrachelizus species 3, Zimmerman, 1991: 151; 1994: 195.

Material examined. Holotype ♂, Rocky R., Via Coen, Cape York Pen., N. Qld, 14–16. xii.1964, G. Monteith (QMB); 2 ex., 12°44'S 143°14'E, 3 km ENE of Mt Tozer, QLD, 28 Jun–4 Jul 1986, T. Weir & A. Calder (ANIC and MNHN); 1 ex., 15°47'S 145°14'E, Shiptons Flat, QLD, 17–19 Oct. 1980, T. Weir (ANIC).

Habitus. Fig. 13.

Distribution. Only known from Australia.

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The Redescription of *Corynethrix obscura* L. Koch, 1876 (Araneae: Thomisidae)—a Crab Spider of a Monotypic Genus from Australia

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ABSTRACT. *Corynethrix obscura* L. Koch, 1876 from Peak Downs, Queensland, Australia is redescribed and fully illustrated. The representatives of this species are characterized by small size, a body covered with clavate and spatulate setae and a distinctive pattern on the dorsum of the opisthosoma. The paper includes taxonomic remarks on three genera within the subfamily Bominae.

SZYMKOWIAK, PAWEŁ, AND AGNIESZKA DYMEK, 2011. The redescription of *Corynethrix obscura* L. Koch, 1876 (Araneae: Thomisidae)—a crab spider of a monotypic genus from Australia. *Records of the Australian Museum* 63(1): 99–102.

The crab spiders of Australia remain a taxon that has been insufficiently investigated. For the majority of Australian species there are no revisionary studies that would allow species identification. Most of the available descriptions originate from the end of the 19th century and, since then, no studies have analysed type material. As a consequence, available information is frequently incomplete and unreliable.

Corynethrix obscura was described in 1876 by Ludwik Koch, on the basis of one female. A male is still unknown. The original description lacked many morphological details and was poorly illustrated. So vague is the description, that almost any species of the three known genera of the subfamily Bominae (Thomisidae) might be misidentified.

Another species was described by Simon: *Corynethrix tuberculata* Simon, 1886. This species was subsequently excluded from the genus *Corynethrix* and made the type species of *Boliscus* Thorell, 1891 (Simon, 1895). Therefore *Corynethrix* Koch, 1876 is monotypic with *C. obscura* as the type species. Little is known of the biology and behaviour of this crab spider (Hawkeswood, 2003).

Material and methods

All measurements were performed using the Olympus SZX12 microscope with magnification of 11–144×. The photos were taken using an Artcam 500 MI camera and Quick Photo Camera 2.3 software. Black and white images were prepared using pencil and Rotring ink pens: 0.25 mm and 0.5 mm.

The following abbreviations and symbols are used: *AMS*, Australian Museum, Sydney; *AME*, anterior median eye; *ALE*, anterior lateral eye; *MOA*, median ocular area delineated by anterior median eyes AME and posterior median eyes PME; *PLE*, posterior lateral eye; *PME*, posterior median eye; *VTA*, ventral tibial apophysis of male palp; x/y, ratio of the distance between PLE=PLE and distance between L–R (distance between left and right margins of cephalothorax on the line running through PLE); *ZMH*, Museum of Zoology, Hamburg, Germany.

In order to obtain new specimens for taxonomic study, the collections of crab spiders of the Australian Museum, Sydney, and the Queensland Museum, Brisbane, were

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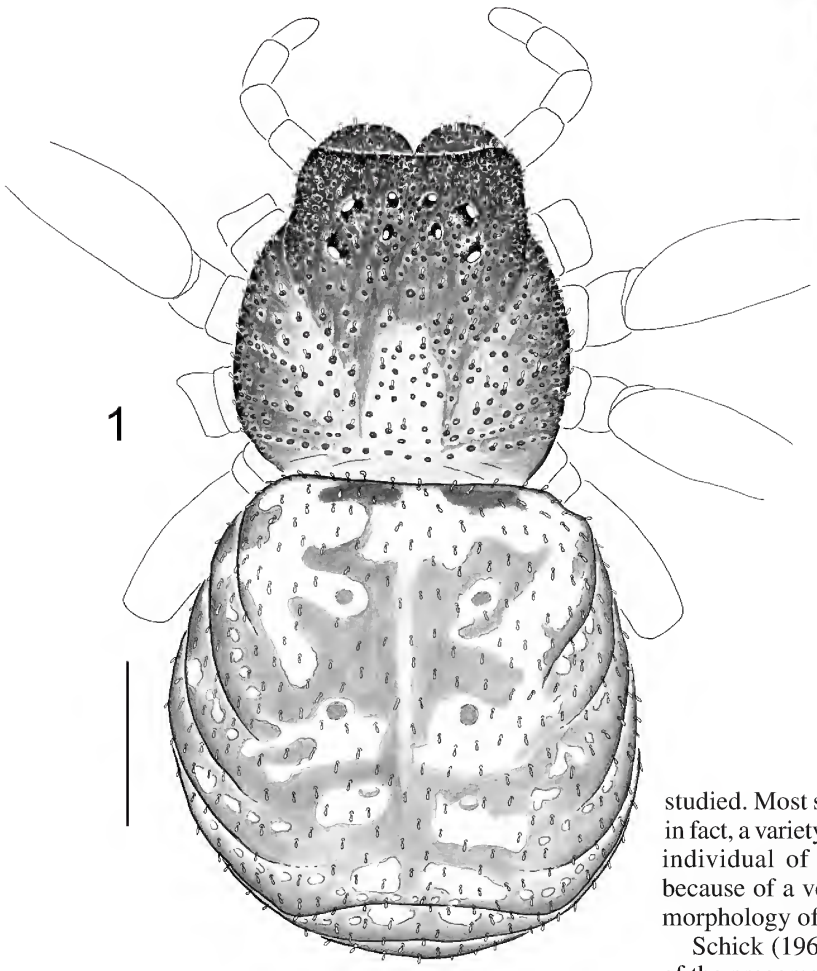

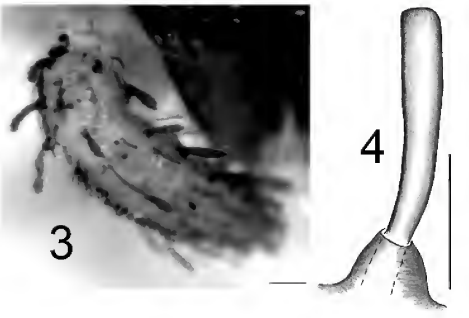

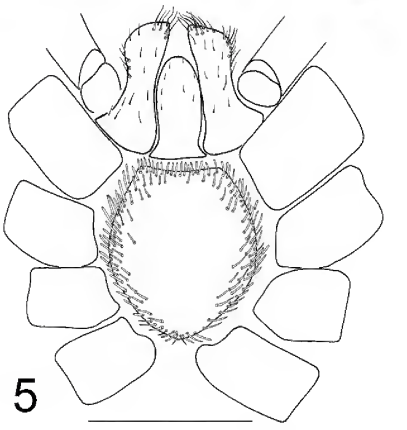

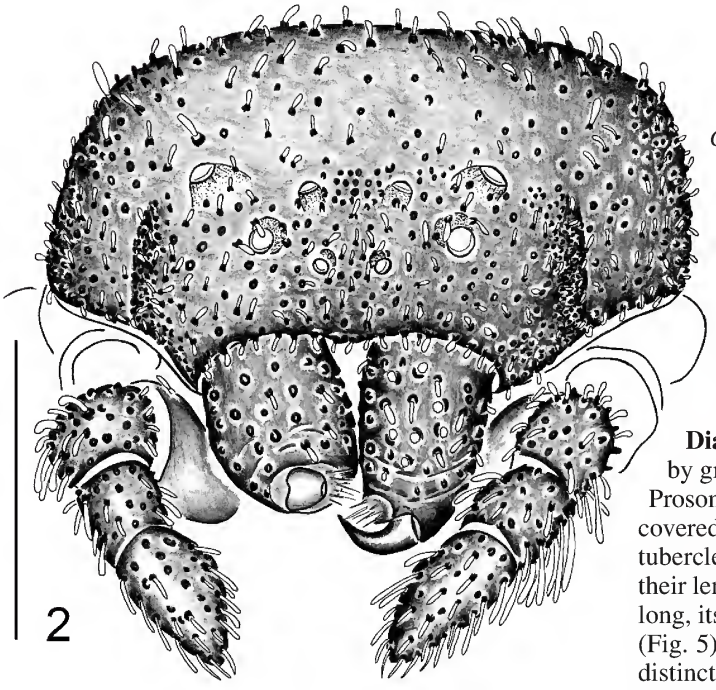

Figs. 1–5. *Corynethrix obscura (1)* habitus; *(2)* prosoma, front view; *(3)* right palp; *(4)* the seta of the left palp; *(5)* labium, maxillae and sternum. Scale bars for 1, 2 and 5 are 1000 μm; for 3 is 50 μm, and for 4 is 100 μm.

studied. Most specimens identified as *Corynethrix* sp. were, in fact, a variety of *Bomis* species. The only available juvenile individual of *C. obscura* was immediately recognized because of a very characteristic abdominal pattern and the morphology of its prosoma.

Schick (1965) described the morphology of the dorsum of the prosoma.

Corynethrix obscura L. Koch, 1876

Figs. 1–7, Table 1

Corynethrix obscura L. Koch, 1876. Die Arachniden Australiens. Nürnberg, 1: 741–888 (805–806, pl. 69, fig. 8, 8a–8d).

Types. Holotype female. Queensland: ZMH (ex. Museum Godeffroy) nr 14609, Peak Downs, under the old tree, leg. Daemel.

Other material examined: AMS KS77325, Port Hacking, New South Wales, 1 juvenile specimen, 7 Sep 1969, leg. N. Allan.

Diagnosis. Species of small size with prosoma covered by granulations. Granulations consist of small tubercles. Prosoma, opisthosoma, legs, chelicerae, palps, and sternum covered by clavate and spatulate setae often sitting on top of tubercles (Figs. 3, 4). Setae are either equally narrow along their length or widen towards their upper part. Labium very long, its length being nearly two times larger than its width (Fig. 5). Legs without spines. Opisthosoma smooth. Three distinctly brighter stripes on prosoma and a characteristic pattern of white spots and bands on opisthosoma, which branch and spread to sides (Figs. 1, 6). On both sides and the rear part of the dorsum of opisthosoma bright longitudinal spots are arranged parallel to each other. Lateral eyes are located on small protuberance but not on tubercles. All eyes

with bright, distinctive tapetum inside. Median and lateral lenses are equal (ALE=PLE>AME=PME).

Redescription of female holotype. *Size*. Body length 5.25 mm, prosoma length 2.28 mm, prosoma width 2.1 mm, prosoma length/width ratio 1.09, opisthosoma length 2.97 mm, opisthosoma width 2.91 mm (length/width ratio 1.41), Fig. 1. —*Prosoma*. Flat with characteristic granulations arranged evenly in dorsal part and with very short flat-shaped setae on most granulations/tubercles. Almost every tubercle of the clypeus and lateral sides of prosoma covered with numerous setae (Fig. 2). Less numerous setae on mesodiscus, metadiscus and allatum. Lack of granulations and setae on posterior declivity. Transparent setae appear white against dark prosoma. Palps with longest flattened setae on the entire body (Figs. 3, 4). Dorsal part of prosoma sloping slightly towards clypeus. Mesodiscus and metadiscus slightly arched. MOA area slightly concave. Sloping clypeus apparent as seen from above, darker than rest of prosoma. Setae arising from tubercles sometimes forming rows along under-integument muscle bands. Prosoma is widest at position where I and II pair of legs are situated and highest in line between posterior declivity and metadiscus. Rear edge very short and strongly sloping downwards. —*Clypeus*. Slightly rough, prominently sloping downwards. Ratio of clypeus (clypeus height/AME-AME) 2.5/1.4 = 1.8. Clypeus highest at side-edges, entirely covered with granulations, mostly near margin. Each granulation provisioned with distinctive setae (Fig. 2). —*Eyes*. Bright colour in adults or grey in juveniles. Front row of eyes slightly curved. Rear row wider than front row. Biggest ocelli chambers ALE (ALE>PLE>AME=PME), biggest lenses AME. Lenses show very characteristic pattern in which median eyes are of equal size with respect to one another and so too are lateral eyes (ALE=PLE>AME=PME). Eyes characterized by largest distance between PLE-PLE, and smallest between AME-AME (AME-AME 0.14 mm, AME–ALE 0.16 mm, ALE–ALE 0.61 mm, ALE–PLE 0.23 mm, PME–PME 0.20 mm, PME–PLE 0.27 mm, PLE–PLE 0.845 mm). Lateral eyes ALE and PLE situated on small protuberances but not on tubercles as usually recorded in some genera of crab spiders (e.g., *Diaea*, *Demonax*, *Rhaebobates*, *Tharpyna*, *Thomisus*, *Tmarus*). Length of MOA area exceeds its width: length 0.38 μm, width in anterior position 0.305 mm, width in posterior position 0.33 mm. x/y ratio 0.795 mm / 1.425 mm = 0.56. —*Chelicerae*. Massive, thickly covered with dense granulations. All granulates ending with clavate setae. Fangs very short and small (Fig. 2). Near fang, prolaterally, on internal side of each chelicera, small bright area with few sharp, narrow spines and one long, sharp seta at base. —*Labium, maxillae*. Length of labium and maxillae exceeds their width. Labium (length/width) 0.575 mm / 0.305 mm, length of maxillae/width of labium+maxillae 0.74 mm / 0.97 mm. Maxillae flat, long, rounded on top and ending with dense scopula (Fig. 5). —*Sternum*. Slightly convex and arched, shield-shaped with numerous, distinctive long setae on margins and shorter ones on central surface (Fig. 5). Length exceeds width (length/width ratio 1.085 mm /0.930 mm = 1.16). —*Legs*. Pair of tarsal claws at end of each leg, claws on legs III and IV with small number of teeth (1–2). Femora in upper and lower parts slightly convex, variously covered with thick clavate spines. At top of tibiae, tarsi and metatarsi long clavate spines (spines of same length, arranged evenly on tibiae and arranged densely on tarsi and metatarsi).

Table 1. The measurements of the holotype female's legs in mm.

leg	tarsus	metatarsus	tibia	patella	femur	total
I	—	—	—	—	—	—
II	—	0.55	0.75	0.535	1.275	—
III	0.36	0.38	0.575	0.61	1.02	2.945
IV	0.435	0.47	0.61	0.51	0.955	2.980

Opisthosoma. Nearly rounded, smooth, without granulations and with several lateral folds and two distinct pairs of apodemes. Frontal margin significantly angular, not rounded (Fig. 1). Cuticula covered evenly with one type of small clavate setae, not located on granulates. Epigyne distinctively marked. Central part of ventral side of abdomen without clavate setae but with tiny, short and acute ones. Spinnerets and anal tubercle small. —*Reproductive organs*. Epigyne with well defined central hood and two rounded, highly transparent spermathecae, showing through integument (Fig. 7). Spermathecae darkening towards their lateral margins. Reproductive plate rounded on top with some delicate furrows on lower part and with numerous, long spini- and fusiform setae around. —*Coloration and markings*. Prosoma, clypeus and chelicerae dark brown. Clypeus and lateral parts of prosoma darker than rest of tagma. On dorsal side of prosoma three distinctive, brighter stripes. Middle stripe distinctively wider and brighter than rest. Other stripes sloping downward towards margins of prosoma. Chelicerae orange-brown, brighter near fangs. Labium and maxillae red-brown near upper margin, and light yellow elsewhere. Sternum shining and covered by transparent/white setae. II pair of legs dark brown, evenly coloured. III and IV pairs of legs brighter (light yellow-brown). Opisthosoma black-brown with numerous white broad spots positioned dorsally and one white stripe in center. On rear half, close to center, three pairs of rounded spots, creeping towards spinnerets and longitudinal, bright spots arranged parallel to each other on both sides of opisthosoma (Figs. 1, 6). Venter of opisthosoma light yellow with white-yellow, sharp hairs. Spinnerets brown-yellow.

Distribution. Peak Downs (Queensland), Port Hacking (New South Wales), Australia.

Taxonomic remarks on the related genera. There are three genera within the subfamily Bominae in Australia. The species which belong to *Boliscus* Thorell, 1891, *Bomis* L. Koch, 1874 and *Corynethrix* L. Koch, 1876 are spiders of small size, covered by granulations or small tubercles on the prosoma and they have thick and short legs (Ono, 1988). *Corynethrix* differs from *Boliscus* by having the opisthosoma without tubercles, from *Bomis* by having the prosoma much flattened with the clypeus characterized by a small height, and from both of the above-mentioned genera by having clavate setae on the prosoma, opisthosoma and on legs. Only the female of *C. obscura* is known.

Notes. Etymology is not explained in the paper alongside the original description. *Obscura* means dark, unclear, indistinct. The name (probably) refers to the body size and colouring which is dark-brown in *C. obscura*. It is possible that the cryptic pattern allows individuals to blend with the background of a tree trunk.

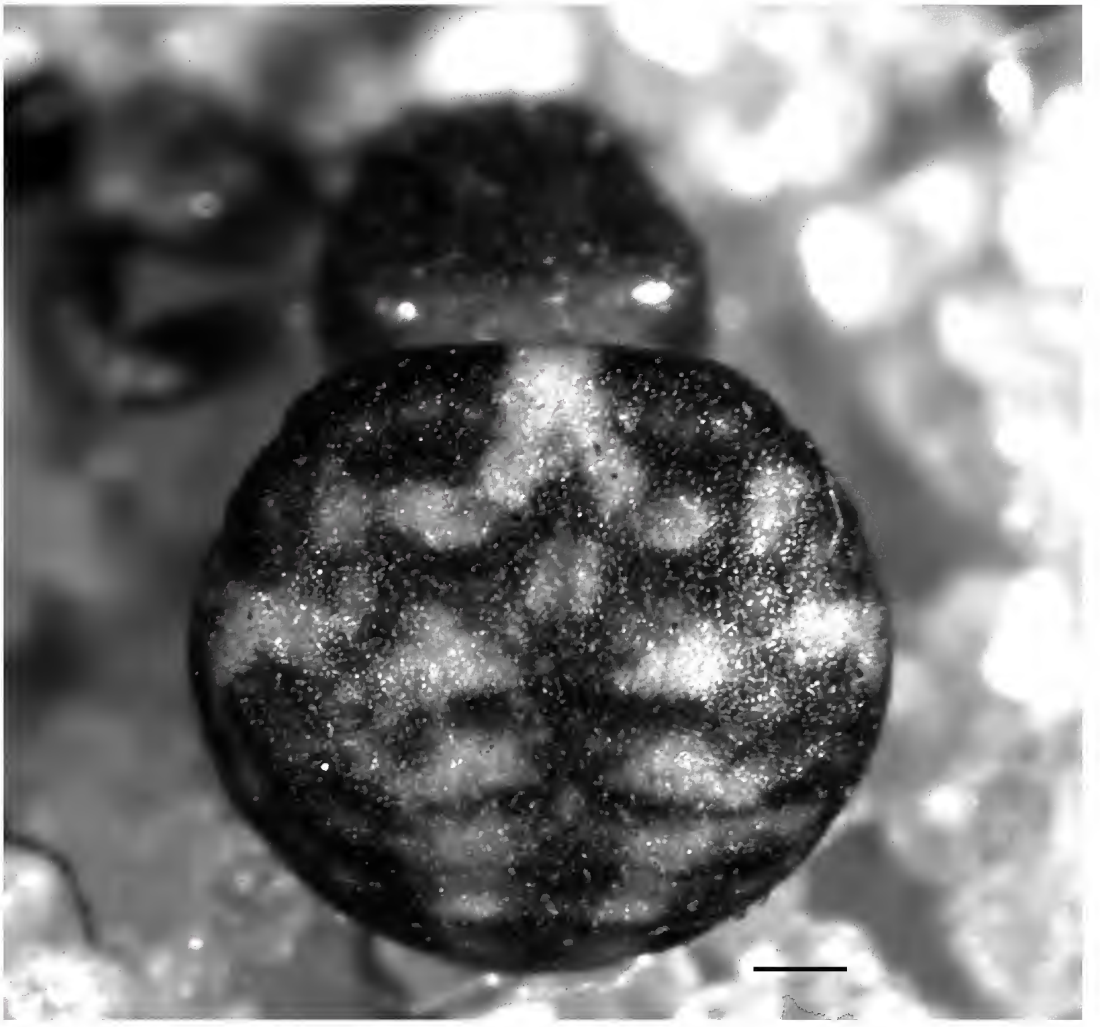

Fig. 6. The pattern on the dorsum of the abdomen of *Corynethrix obscura*. Scale bar 200 μm.

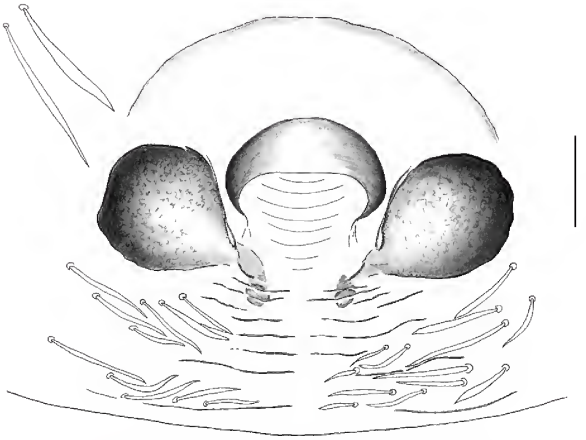

Fig. 7. The epigyne of *Corynethrix obscura*. Scale bar 100 μm.

The female holotype is missing right leg I and left legs I and II, the tarsi on the right and left leg II and the claw on the right chelicera. It was impossible to analyze vulval structures because of the Zoological Museum Hamburg regulations preventing dissection of holotype specimens.

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The Genus *Tachydromia* Meigen (Diptera: Hybotidae) from Australia

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ABSTRACT. First data on the genus *Tachydromia* Meigen from Australia are provided including descriptions of five new species: *T. australiensis* n.sp. (New South Wales), *T. bickeli* n.sp. (New South Wales), *T. carnarvonensis* n.sp. (Queensland), *T. corticola* n.sp. (New South Wales, Queensland), *T. nowendociensis* n.sp. (New South Wales). Hypothesized phylogenetic relationships of the new species (also *T. papuana* Grootaert known from Papua New Guinea) are briefly discussed. A key to Australasian *Tachydromia* is provided.

GROOTAERT, PATRICK, & IGOR SHAMSHEV, 2011. The genus *Tachydromia* Meigen (Diptera: Hybotidae) from Australia. *Records of the Australian Museum* 63(1): 103–112.

Introduction

This paper continues the world revision of the genus *Tachydromia* Meigen recently initiated by the authors (Shamshev & Grootaert, 2008). The genus is almost worldwide in distribution and currently includes 110 described species. However, only one species of *Tachydromia* has been described from the entire Australasian region, namely *T. papuana* Grootaert, 1987 from Papua New Guinea. Consequently, we provide here the first data on the genus from Australia including descriptions of five new species taken there. Additionally, a new record of *T. papuana* from Papua New Guinea is reported.

Materials and methods

This study is based on material borrowed from the Australian Museum, Sydney (AMS), the Bernice P. Bishop Museum, Honolulu, Hawaii (BPBM), the Queensland Museum, Brisbane (QMB), the Canadian National Collection of Insects, Ottawa, Ontario (CNC), and the Royal Belgian Institute of Natural Sciences, Brussels (RBINS). Pinned specimens were examined, of which most material was collected in Malaise or sticky traps and then was dried from alcohol. Terms used for adult structures primarily follow those of McAlpine (1981), although the terminology for the antenna follows Stuckenberg (1999); and for the male terminalia follows Sinclair & Cumming (2006). To facilitate observations, the terminalia were macerated in cold 10% KOH and hot 85% lactic acid and immersed in glycerine. Drawings of morphological features were made with a camera lucida attached to a compound microscope.

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In descriptions, right and left side of the male terminalia are based on the unrotated position viewed posteriorly, such that in the illustrations the right surstylus appears on the readers left side and the left surstylus appears on the readers right. All male terminalia are figured in their unrotated position. Compared with other biogeographic realms the Australasian species of *Tachydromia*, especially those of Continental Australia, are very uniform externally and cryptic, often difficult to distinguish. Each specimen requires careful comparison because separation of Australian sympatric species is based on slight differences in leg colouration, and shape and form of the male terminalia.

Key to *Tachydromia* from Australasia

1 Palpus with short subapical seta, which is shorter than palpus. Thorax largely shining 2

—— Palpus with very long subapical seta, which is 1.5–2.0 times as long as palpus. Thorax entirely pollinose 3

2 Prothoracic sclerites (including anterior part of postpronotal lobe) densely silvery grey pollinose (Australia) ..... *T. carnarvonensis* n.sp.

—— Only prosternum densely silvery grey pollinose (Papua New Guinea) ..... *T. papuana* Grootaert

3 Fore and mid femora entirely yellow to dusky yellow, hind femur yellowish basally (Australia) ..... *T. corticola* n.sp.

—— All femora partly brown 4

4 Fore femur almost entirely brown, yellowish on extreme apex (Australia) ..... *T. australiensis* n.sp.

—— Fore femur at least broadly yellowish basally 5

5 Fore femur with broad brown ring on apical half (except narrow subapical space) (Australia) ..... *T. bickeli* n.sp.

—— Fore femur brownish on about apical half (broader dorsally) (Australia) ..... *T. nowendociensis* n.sp.

Tachydromia australiensis n.sp.

Fig. 1

Type material. HOLOTYPE ♂, Australia, New South Wales, Wentworth Falls, Jamison Ck., cascades, 3.01.1994, B.J. Sinclair (AMS 264358). PARATYPES: 3♀♀, Wentworth Falls, Blue Mts, 6 Dec 1986, D.K. McAlpine, K.C. Khoo, R. de Keyzer; AMS K258731, AMS K258890 and AMS K258749; 1♀, 10 km SE Nowendoc, 850 m, on tree trunk, 25.03.1985, D.J. Bickel, AMS K258828.

Diagnosis. Recognized by almost entirely brownish legs; fore femur yellowish on extreme apex.

Description. *Male* length: body 1.9 mm, wing 1.8 mm. *Head* black in ground-colour. Eyes with posterior margin produced far beyond ocellar tubercle; vertex narrower than frons in front of ocellar tubercle. Occiput including vertex almost entirely densely greyish pollinose, with shining patch behind mouth-opening; 2 inclinate, rather short, black postvertical setae, some pale setae around neck and near mouth-opening and row of minute postoculars. Ocellar tubercle pollinose, with 2 short lateroclinate setae. Frons greyish pollinose, slightly widened toward ocellar tubercle, above antennae nearly as broad as anterior ocellus. Antenna with scape and pedicel brownish yellow, postpedicel and stylus missing in holotype. Palpus unmodified, slender, rounded apically, shorter than proboscis, brownish; lacking silvery setae, with some scattered black setulae and bearing very long (nearly 1.5 times as long as palpus) black subapical seta. *Thorax* black in ground-colour, entirely greyish pollinose. Postpronotal lobe large, lacking conspicuous setae, with some minute setulae. Mesonotum with 1 notopleural (accompanied with 1 short setula anteriorly), 1 minute hair-like postalar and 2 scutellars (nearly as long as notopleural seta); some minute setulae present behind postpronotal lobe; mesosternum and metasternum bare between posterior four coxae. Acrostichals minute, arranged in 2 regular rows, ending before prescutellar depression. Dorsocentrals uniserial, mostly minute, prescutellar pair somewhat longer. *Legs* long, slender, almost entirely brownish; fore femur on extreme apex and knees yellowish; fore tibia and basal 2/3 of hind tibia brownish yellow, all tibiae paler dorsally; fore tarsomeres 1–3 yellowish, tarsomeres 4–5 brownish, mid and hind tarsomere 1 largely yellowish (except narrowly on apical part). Coxae mostly with short pale hair-like setae, bearing some longer and stronger setae apically (in some paratypes black subapical setae present), finely pollinose. Fore femur strongly thickened, pale pubescent ventrally, with pale and dark anteroventral and posteroventral setulae becoming longer basally. Fore tibia slightly spindle-shaped. Mid femur slender, slightly swollen on basal half, with rows of anteroventral and posteroventral spinule-like setulae on swollen part. Mid tibia slightly thickened toward apex, lacking subapical projection, with ventral spinule-like setulae. Hind leg unmodified, lacking prominent setae. *Wing* normally developed, rounded at apex, with unmodified venation; two broad brown bands connected on cells r_1 and r_{2+3} leaving narrow basal (except extreme base), apical and median hyaline spaces. One short costal bristle present. Vein R_{2+3} straight. Veins R_{4+5} and M_{1+2} parallel toward wing-apex. Crossveins r-m and bm-cu separated. Calypter pale coloured and fringed. Halter with whitish knob and brownish yellow stem. *Abdomen* largely black in ground-

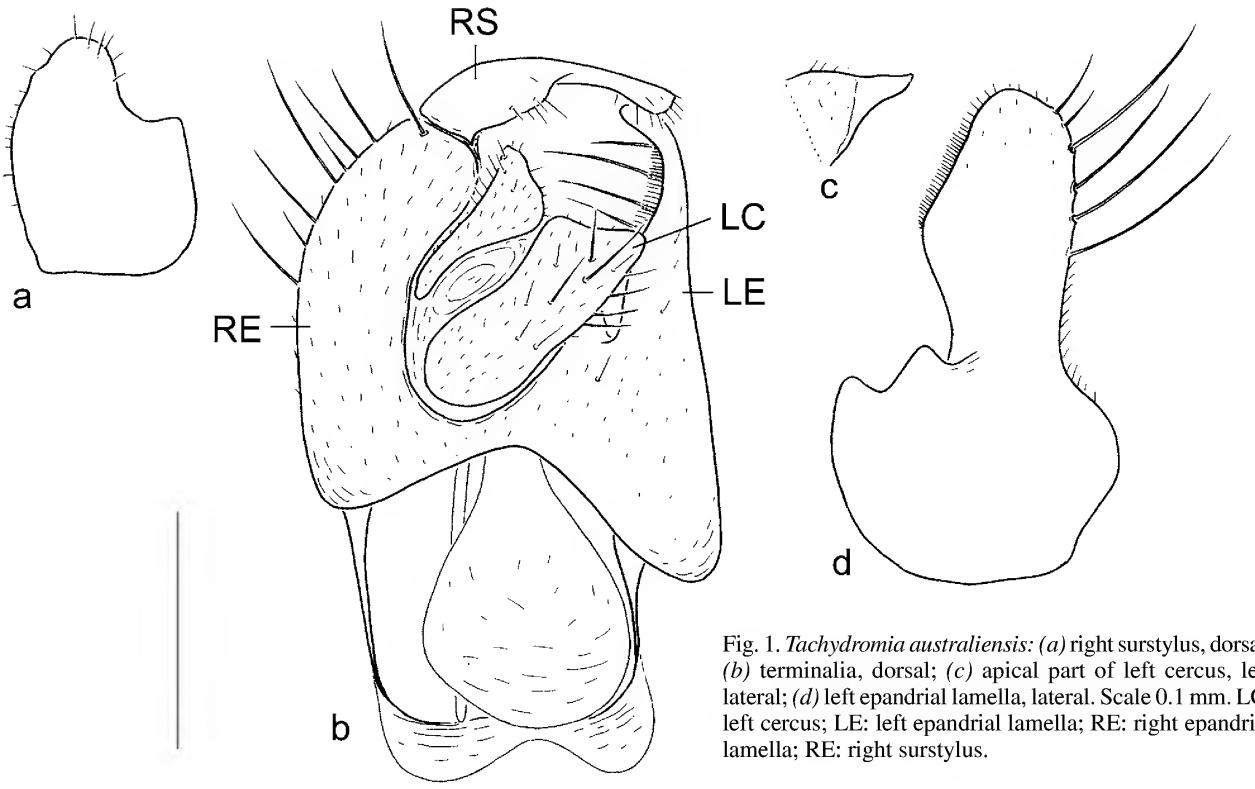

Fig. 1. *Tachydromia australiensis: (a)* right surstylus, dorsal; *(b)* terminalia, dorsal; *(c)* apical part of left cercus, left lateral; *(d)* left epandrial lamella, lateral. Scale 0.1 mm. LC: left cercus; LE: left epandrial lamella; RE: right epandrial lamella; RE: right surstylus.

colour but with segments 1–2 almost entirely pale yellow leaving narrow brownish traces of sclerotization on tergites; greyish pollinose; covered with scattered black setae longer on pregenital segment. *Terminalia* (Fig. 1) rather small, subglobular, blackish brown. Right cercus subtriangular, with unmodified short setae. Left cercus larger than right cercus, subrectangular viewed dorsally with left upper corner slightly produced and pointed (viewed laterally); with several unmodified setae of different lengths. Right epandrial lamella subtriangular (viewed laterally), lacking ventral subapical process, with several unmodified setae of different lengths. Right surstylus differentiated from epandrium, bent inward, subrectangular but with deep notch on right upper corner, bearing several spinule-like setae apically and on inner side. Left surstylus undifferentiated from epandrium; left epandrial lamella subtriangular, with several very long subapical ventral marginal setae. Hypandrium with 3 very short setae. Phallus short.

Female. Antenna with postpedicel and stylus brownish yellow to brownish; postpedicel, drop-like, short, about 1.5 times as long as wide; stylus very long, about 4.0 times as long as pedicel and postpedicel combined. Mid femur unmodified, slender, with rows of minute anteroventral and posteroventral setulae becoming longer basally. Mid tibia slender. Otherwise as in male. Cercus brown, long, slender, covered with minute setulae.

Etymology. The new species is named after the continent of its origin, Australia.

Distribution. This species is currently known from three localities in New South Wales. According to labels it was collected in the beginning of December and January and at the end of March (last sample on tree trunk, 850 m).

Tachydromia bickeli n.sp.

Fig. 2

Type material. HOLOTYPE ♂, Australia, New South Wales, Fenwicks Ck, Doyles Riv. SF, 6.12.1986, D.J. Bickel; AMS K258849. PARATYPES: 1♀, same data as in holotype, AMS K258832; 1♂, 10 km NE of "Tuglo", 48 km N of Singleton, N.S.W., Dec 1981, B.J. Day, AMS K258761; 1♂, 33 km NNE Singleton, "Tuglo", on *E. caniculata*, 17.11.1985, D.J. Bickel, AMS K258793; 1♂, Styx River SF, 1300 m Cunnawarra Rd nr Georges Ck, cool temperate rain forest, sticky trap on tree, 19–20.12.1998, D.J. Bickel, AMS K258863; 1♂, Tuglo, 48 km N of Singleton, 15 Nov. 1985, AMS K258745; 1♂, Carrai SF, 31°00'19"S 152°16'24"E, 940 m, E. Tasker, 11.01–16.01.1998, sticky trap on *E. saligna*, CS-PG-018–3, AMS K258876; 1♂, Coombadjha Ck, Washpool NP, rainforest, sticky traps trunks, 29°25'S 152°23'E, 12–13.01.2001, D. Bickel, AMS K258813; 1♀, Barrington Tops NP, Upper Williams R., 550 m, tree trunk *E.* sp., 26.01.1987, D.J. Bickel, AMS K258728; 1♀, Mt. Royal nr. Singleton, 20 Nov. 1988, B.J. Day, AMS K258739; 1♀, Wenikimbe NP, 900 m, Mooraback area, sticky trap snow gum, 17–19.11.1998, D. Bickel, AMS K258727; 1♀, Coombadjha Ck, Washpool S.F., 10 Feb. 1982, B.J. Day, AMS K258825; 3♀♀, Royal NP, Bela Ck., closed forest, 12.02.1985, D.J. Bickel, AMS K258831, AMS K258838, AMS K258846; 1♀, Esk River, nr Iluka, rain forest, 24.11.1985, D. Bickel & G. Cassis, AMS K259315; 1♀, Myall Lakes Nat. Park, 22.11.1985, D.B. Bickel & G. Cassis, AMS K258882; 1♂, Fenwicks Ck, Dayles River State Forest, 6.xii.1986, 1056 m, D.J. Bickel (AMS); 1♀, 33 km NNE Singleton, 17.xi.1985, "Tuglo", D.J. Bickel, on *E. caniculata*.

Additional material. NEW SOUTH WALES: 1♀, Wentworth Falls, Blue Mts, 6.12.1986, D.K. McAlpine, K.C. Khoo, R. de Keyzer; AMS K258744. 1♀, Banda Banda FR, 31.10S 152.26E, 1020 m, temporary rain forest, sticky trap *Nothofagus*, 19.11.1998, D. Bickel; AMS K258795. These specimens are in bad condition that is why we did not include them to the paratypes.

Diagnosis. Recognized by the fore femur with broad brown ring in apical half leaving narrow, yellow subapical space, mid and hind femora entirely brown.

Description. *Male* length: body 1.7–1.9 mm, wing 1.8–1.9

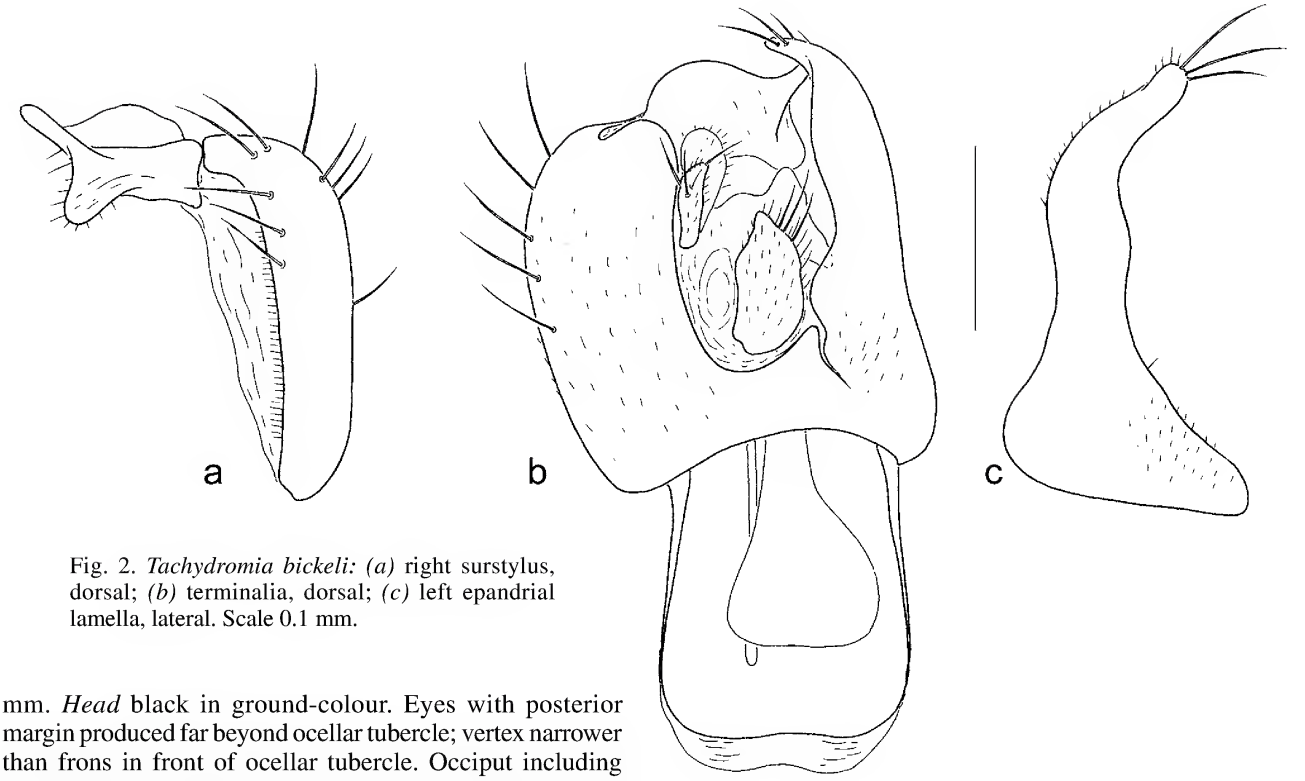

Fig. 2. *Tachydromia bickeli: (a)* right surstylus, dorsal; *(b)* terminalia, dorsal; *(c)* left epandrial lamella, lateral. Scale 0.1 mm.

mm. *Head* black in ground-colour. Eyes with posterior margin produced far beyond ocellar tubercle; vertex narrower than frons in front of ocellar tubercle. Occiput including vertex almost entirely densely greyish pollinose, with shining patch behind mouth-opening; 2 inclinate, short, black postvertical setae, some pale setae around neck and near mouth-opening and row of pale minute postoculars. Ocellar tubercle pollinose, with 2 moderately long lateroclinate setae. Frons greyish pollinose, slightly widened toward ocellar tubercle, above antennae nearly as broad as anterior ocellus. Antenna with scape, pedicel and postpedicel yellow to dusky yellow, stylus brownish. Postpedicel drop-like, short, nearly 1.5 times as long as wide; stylus apical, very long, nearly 3.0 times as long as pedicel and postpedicel combined. Palpus unmodified, slender, rounded apically, shorter than proboscis, brownish; lacking silvery setae, with some scattered black setulae and bearing very long (nearly 2.5 times as long as palpus) black subapical seta. *Thorax* black in ground-colour, entirely finely greyish pollinose. Postpronotal lobe large, lacking conspicuous setae, with some minute setulae. Mesonotum with 1 black moderately long notopleural (accompanied with 1–2 very short setae), 1 minute hair-like postalar and 2 scutellars (nearly as long as notopleural seta); some minute setulae present behind postpronotal lobe; mesosternum and metasternum bare between posterior four coxae. Acrostichals minute, arranged in 2 regular rows, ending before prescutellar depression. Dorsocentrals uniserial, mostly minute, prescutellar pair somewhat longer. *Legs* long, slender, with brown and yellow pattern; coxae and trochanters entirely yellow, fore femur with broad brown ring in apical half leaving narrow subapical space yellow, mid and hind femora entirely brown, fore tibia (except base, apex and dorsal face), mid tibia (except extreme base) and apical 1/4 of hind tibia brown, fore and mid tarsomeres 1–4 yellow, tarsomere 5 brownish to brownish yellow, hind basitarsus yellow (except brownish yellow apex), tarsomeres 2–5 entirely brownish yellow. Coxae with yellowish unmodified setae, finely pollinose. Fore femur strongly thickened, pale pubescent ventrally, with yellowish anteroventral and posteroventral setulae becoming longer basally. Fore tibia spindle-shaped. Mid femur slender, slightly swollen on basal 1/3, with rows of short brownish anteroventral and posteroventral spine-like setae becoming shorter and disappearing beyond median swelling, bearing 3–4 even stronger black posterodorsal setae just beyond swelling. Mid tibia with hardly prominent apical projection and ventral spinule-like setulae. Hind leg unmodified, lacking prominent setae. *Wing* normally developed, rounded at apex, with unmodified venation; two broad brownish bands connected on cells r_1 and r_{2+3} leaving narrow basal (except extreme base), apical and median hyaline spaces. One short costal bristle present. Vein R_{2+3} straight. Veins R_{4+5} and M_{1+2} parallel toward wing-apex. Crossveins r-m and bm-cu almost coalescent (in some specimens coalescent). Calypter dusky yellow with concolorous fringe. Halter with yellow stem and pale knob. *Abdomen* largely brown in ground-colour but with segments 1–2 dusky yellow; finely greyish pollinose; covered with scattered black setae longer on pregenital segment. *Terminalia* (Fig. 2) moderately large, rather elongate oval, blackish brown. Right cercus short, narrow, with unmodified short setae. Left cercus larger than right cercus, elongate-oval; with several unmodified setae of different lengths. Right epandrial lamella subtriangular (viewed laterally), lacking ventral subapical process, with several unmodified setae of different lengths. Right surstylus differentiated from epandrium, bent inward, of complicated structure, bearing several unmodified setulae. Left surstylus undifferentiated from epandrium; left epandrial lamella subtriangular, long, narrow, with several very long subapical marginal setae. Hypandrium with 2 very short setae. Phallus short.

Female. Tibiae are usually paler than in males and femora even have a tendency to be paler basally. Mid femur unmodified, slender, with rows of short brownish antero-

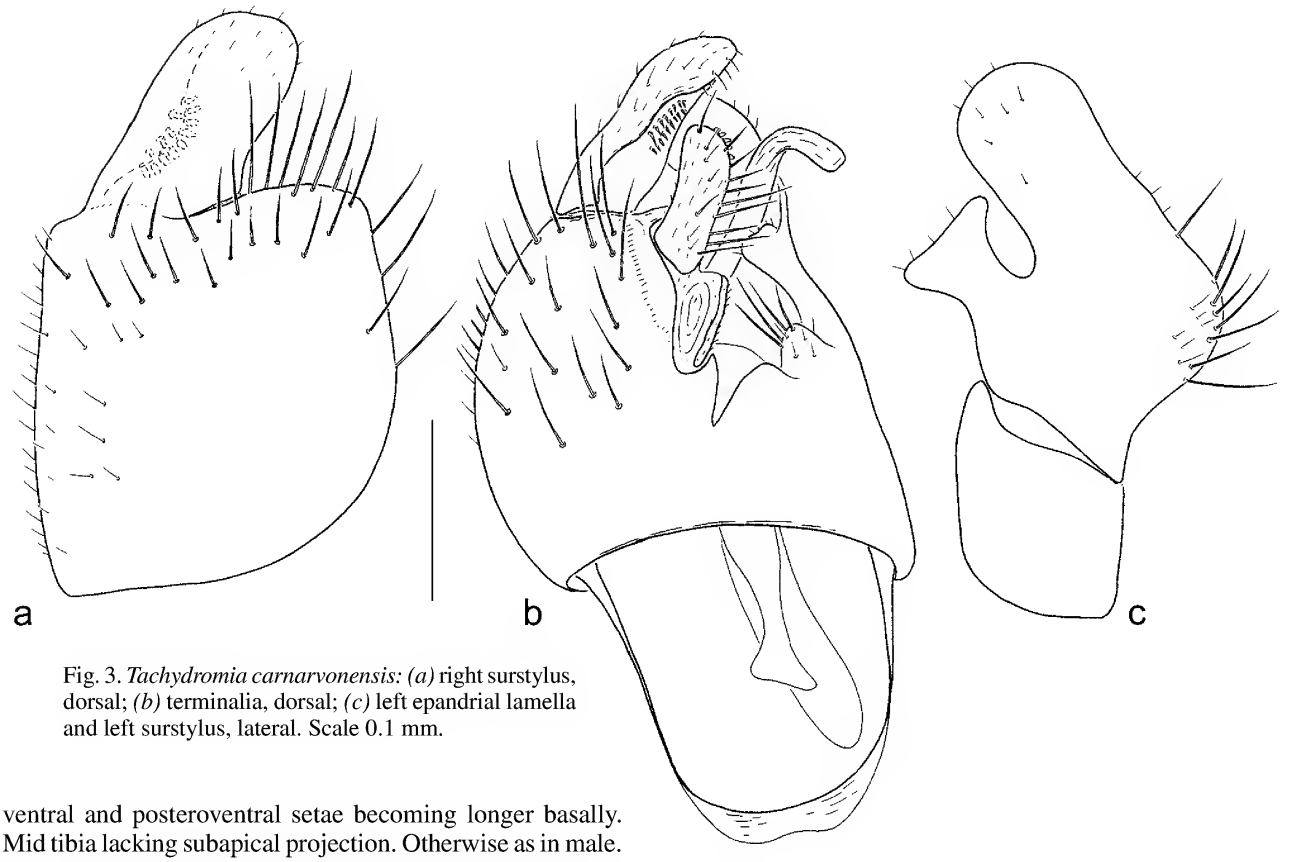

Fig. 3. *Tachydromia carnarvonensis: (a)* right surstylus, dorsal; *(b)* terminalia, dorsal; *(c)* left epandrial lamella and left surstylus, lateral. Scale 0.1 mm.

ventral and posteroventral setae becoming longer basally. Mid tibia lacking subapical projection. Otherwise as in male. Cercus brown, long, slender, covered with minute setulae.

Etymology. The specific name is a patronym in honour of Daniel J. Bickel (Sydney), the collector of the majority of the type series, who has contributed greatly to the knowledge of Australasian empidoid Diptera.

Distribution. This species is currently recorded from many localities in New South Wales and it appears to be commonest species of *Tachydromia* there. According to labels *T. bickeli* n.sp. was collected in rain forest (cool, closed or temperate; 550–1300 m) and taken from trunks of snow gum *Eucalyptus pauciflora, E. caniculata, E. saligna* and *Nothofagus* sp. on dates from middle of November to middle of February.

Tachydromia carnarvonensis n.sp.

Fig. 3

Type material. HOLOTYPE ♂, Australia, Queensland, Carnarvon Nat. Pk, Mt. Moffat Sect. E. branch Maranoa River, nr. Top Moffat Cmp (25°03.2'S 148°03.5'E), 10–11.x.2002, J.M. Cumming, PT [QMB].

Diagnosis. This species can be readily recognized among Australian congeners by a short subapical seta on the palpus and largely shining thorax with prothoracic sclerites (including anterior part of postpronotal lobe) densely silvery grey pollinose.

Description. *Male* length 2.0 mm; wing 1.9 mm. *Head* black in ground-colour, with black setation. Eyes with posterior margin slightly produced beyond ocellar tubercle; vertex broader than frons in front of ocellar tubercle. Occiput almost entirely shining, with narrow space of fine pollinosity between vertex and neck; vertex entirely shining; 2 inclinate, long, black postvertical setae, some setae around neck and near mouth-opening and row of minute postoculars. Ocellar tubercle shining, with 2 short lateroclinate setae. Frons shining, slightly widened toward ocellar tubercle, above antennae 2.0–2.5 times broader than anterior ocellus. Antenna brownish. Postpedicel elongate oval, short, with somewhat long subapical brownish stylus which is about 3.0 times as long as pedicel and postpedicel combined. Palpus unmodified, slender, pointed, nearly as long as proboscis, brownish; lacking silvery setae, with some scattered black setulae and bearing moderately long (somewhat shorter than palpus) black apical seta. *Thorax* black in ground-colour, almost entirely shining; prothoracic sclerites (including anterior part of postpronotal lobe) densely silvery grey pollinose, scutellum, metanotum and hypopleuron greyish pollinose. Postpronotal lobe large, lacking conspicuous setae. Mesonotum with 1 notopleural [missing], 1 moderately long black postalar and 2 similar scutellar setae; some minute setulae present behind postpronotal lobe; mesosternum and metasternum bare between posterior four coxae. Acrostichals lacking. Dorsocentrals partly missing, arranged in 1 row, mostly minute (including prescutellars), at least one pair on middle part strong. *Legs* long, slender, almost entirely brownish; fore and hind coxae (except extreme base), trochanters, fore and mid femora on extreme base and apex, hind femur on about basal 1/5 and tibia on extreme base yellowish; fore tarsomeres 1–3 yellowish, tarsomeres 4–5 brown, mid and hind tarsomeres becoming gradually darker from tarsomere 1 (almost entirely yellowish) to tarsomere 5. Coxae mostly with short pale hair-like setae, bearing some longer and stronger setae apically; fore coxa anteriorly, mid and hind coxae laterally silvery grey pollinose. Fore femur

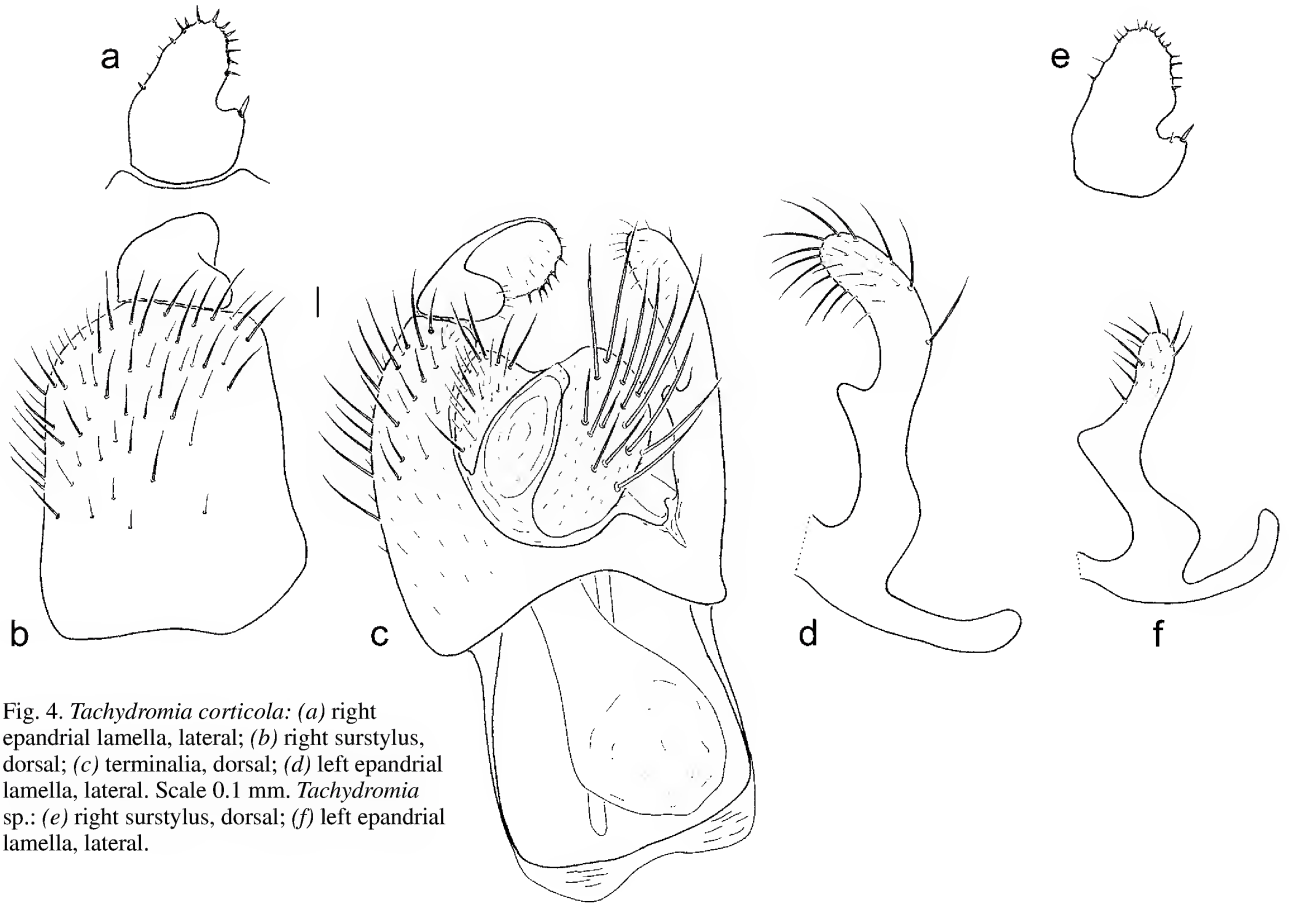

Fig. 4. *Tachydromia corticola: (a)* right epandrial lamella, lateral; *(b)* right surstylus, dorsal; *(c)* terminalia, dorsal; *(d)* left epandrial lamella, lateral. Scale 0.1 mm. *Tachydromia* sp.: *(e)* right surstylus, dorsal; *(f)* left epandrial lamella, lateral.

slightly thickened, pale pubescent ventrally, with minute dark anteroventral and posteroventral setulae longer basally. Fore tibia slightly spindle-shaped. Mid femur slender, with rows of anteroventral and posteroventral setae stronger on apical half of the femur. Mid tibia with hardly prominent subapical projection, bearing black ventral spinule-like setulae. Hind leg unmodified, lacking prominent setae. *Wing* normally developed, rounded at apex, with unmodified venation; two broad brown bands connected on cells r_1 and r_{2+3} leaving narrow basal, apical and median hyaline spaces. One short costal bristle present. Vein R_{2+3} slightly arched about middle toward costa. Veins R_{4+5} and M_{1+2} parallel toward wing-apex. Crossveins r-m and bm-cu separated. Calypter pale coloured and fringed. Halter whitish. *Abdomen* entirely blackish brown; tergites subshining, finely greyish pollinose, sternites shining; with scattered minute dark setulae. *Terminalia* (Fig. 3) rather large, elongate oval, blackish brown. Right cercus rather short, subrectangular, with several setae of different lengths and bearing 5 short subapical spines on inner side. Left cercus hardly prominent, with minute setulae. Right epandrial lamella subrectangular, covered with numerous setae of different length, lacking ventral process. Right surstylus hardly differentiated from epandrium, broad, rather long, slightly curved inward, with numerous moderately long subapical setae and several spines on inner side. Left surstylus differentiated from epandrium, bilobed; upper lobe broad, rather long, with several setae of different length; lower lobe small, with several short setae. Hypandrium humped basally, lacking setae. Phallus elongate.

Female. Unknown.

Etymology. The epithet refers to Carnarvon National Park where the new species was collected.

Distribution. This species is currently recorded from a single locality in Queensland, taken in the beginning of October.

Remarks. *Tachydromia carnarvonensis* n.sp. is very similar to *T. papuana* described from Papua New Guinea (Grootaert, 1987). The main distinguishing characters between these species are given in the key.

Tachydromia corticola n.sp.

Fig. 4a–d

Type material. HOLOTYPE ♂, Australia, Queensland, Ravensbourne NP, under bark *E. saligna*, 8.12.1985, D.J. Bickel; AMS K258776. PARATYPES: QUEENSLAND. 1♂, same data as in holotype, with additional labels; *Tachydromia* sp., det. B.J. Sinclair, 1993; AMS K258844. 1♀, same data as in holotype, with additional label; AMS K258773. 1♂, Conondale Ra., Bundaroo Creek, rainforest, G. Cassis & D. Bickel; AMS K258303. NEW SOUTH WALES. 1♀, Wentworth Falls, Blue Mts, 6.12.1986, D.K. McAlpine, K.C. Khoo, R. de Keyzer; AMS K258834. 1♀, Carrai SF, 30°54'19"S 152°17'36"E, 1550 m, sticky trap on *E. campanulata*, CC-DP-018-5, 11.01–16.01.1998, E. Tasker; AMS K258854. 1♀, nr. Gosford, Mooney Mooney Ck., wet scler. forest, 3.12.1985, D.J. Bickel; AMS K258781.

Diagnosis. Recognized by fore and mid femora entirely yellow, hind femur yellowish basally.

Description. *Male* length: body 1.9–2.0 mm, wing 1.9–2.0 mm. *Head* black in ground-colour. Eyes with posterior margin produced far beyond ocellar tubercle; vertex narrower than frons in front of ocellar tubercle. Occiput including vertex almost entirely densely greyish pollinose, with shining patch behind mouth-opening; 2 inclinate, short, black postvertical setae, some pale setae around neck and near mouth-opening and row of pale minute postoculars. Ocellar tubercle pollinose, with 2 moderately long lateroclinate setae. Frons greyish pollinose, slightly widened toward ocellar tubercle, above antennae nearly as broad as anterior ocellus. Antenna with scape, pedicel and postpedicel dusky yellow, stylus brownish. Postpedicel drop-like, short, nearly 1.5 times as long as wide; stylus apical, very long, nearly 3.0 times as long as pedicel and postpedicel combined. Palpus unmodified, slender, rounded apically, shorter than proboscis, brownish; lacking silvery setae, with some scattered black setulae and bearing very long (nearly 2.5 times as long as palpus) black subapical seta. *Thorax* with prothoracic sclerites and anterior part of mesopleuron brownish yellow in ground-colour, otherwise thorax blackish brown in ground-colour, entirely finely greyish pollinose. Postpronotal lobe large, lacking conspicuous setae, with some minute setulae. Mesonotum with 1 black moderately long notopleural (accompanied with 1 very short seta anteriorly), 1 minute hair-like postalar and 2 scutellars (nearly as long as notopleural seta); some minute setulae present behind postpronotal lobe; mesosternum and metasternum bare between posterior four coxae. Acrostichals minute, arranged in 2 regular rows, ending before prescutellar depression. Dorsocentrals uniserial, mostly minute, prescutellar pair somewhat longer. *Legs* long, slender; hind femur brown on about apical half, fore and mid tibiae anteriorly and posteriorly brownish, hind tibia brown on apical 1/4, fore and mid tarsomere 5 brown, hind tarsomere 2 apically and hind tarsomeres 3–5 entirely brownish yellow, otherwise legs yellow to dusky yellow (basal part of hind tibia and hind basitarsus rather pale yellow). Coxae with yellowish unmodified setae, finely pollinose. Fore femur strongly thickened, pale pubescent ventrally, with yellowish anteroventral and posteroventral setulae becoming longer basally. Fore tibia slightly spindle-shaped. Mid femur slender, slightly swollen on basal half, with rows of anteroventral and posteroventral spine-like setae on swollen part (the latter darker and stronger, the former becoming longer basally) and bearing 4 even stronger black posterodorsal setae before swelling. Mid tibia with short apical projection, bearing ventral spinule-like setulae. Hind leg unmodified, lacking prominent setae. *Wing* normally developed, rounded at apex, with unmodified venation; two broad brownish bands connected on cells r_1 and r_{2+3} leaving narrow basal (except extreme base), apical and median hyaline spaces. One short costal bristle present. Vein R_{2+3} straight. Veins R_{4+5} and M_{1+2} parallel toward wing-apex. Crossveins r-m and bm-cu contiguous. Calypter dusky yellow with concolorous fringe. Halter yellow. *Abdomen* largely brown in ground-colour but with segments 1–2 dusky yellow; finely greyish pollinose; covered with scattered black setae longer on pregenital segment. *Terminalia* (Fig. 4) moderately large, rather elongate oval, blackish brown. Right cercus subtriangular, with numerous unmodified moderately long setae. Left cercus larger than right cercus, elongate-oval; with numerous very long strong setae. Right epandrial lamella subrectangular (viewed laterally), lacking ventral subapical process, with numerous unmodified setae of different lengths. Right surstylus differentiated from epandrium, bent inward, rather subrectangular but with deep notch on right upper corner, bearing several spinule-like setae apically and on inner side. Left surstylus undifferentiated from epandrium; left epandrial lamella long narrow, with short dorsal projection on about middle, bearing several long subapical ventral marginal setae. Hypandrium with subapical tubercle bearing several short setae. Phallus short.

Female. Mid femur unmodified, slender, with rows of short anteroventral and posteroventral setulae becoming longer basally. Mid tibia lacking apical projection. Otherwise as in male. Cercus brown, long, slender, covered with minute setulae.

Etymology. The epithet "*corticola*" refers to a habit of the new species "living on bark".

Distribution. *Tachydromia corticola* n.sp. is currently known from several localities in New South Wales and Queensland. This species was collected in rainforest (under bark of *E. saligna*, on trunk of *E. campanulata*, 1550 m) and it was taken in December and January.

Tachydromia sp.

Fig. 4e,f

Material examined. NEW SOUTH WALES: 2♂♂, Port Macquarie Sea Acres NR; 10 m, subtropical rainforest, malaise trap, 10–24.12.1999, G. Williams; AMS K258809 and K258729. 1♂, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 14–28.02.1999, G. Williams; AMS K258845. 1♂, Mt. Warning Nat. Pk., 24.11.1985, D. Bickel & G. Cassis; AMS K258324.

QUEENSLAND: 1♂, 28.204°S 153.129°E, Lamington NP, IBISCA Qld Plot# IQ-700-D, 780 m, rainforest, sticky trap 23121, 30.03.2007–2.04.2007, D. Bickel; AMS K258732.

Remarks. These specimens are very similar to and indistinguishable externally from *T. corticola* n.sp. There are only slight differences in structure of the male terminalia, namely in the shape of right surstylus and left epandrial lamella (Fig. 4d,e). We prefer not to rank these specimens as a separate species until a longer series is available and the range of variability is clear.

Tachydromia nowendociensis n.sp.

Fig. 5

Type material HOLOTYPE ♂, Australia, New South Wales, 10 km SE Nowendoc, 850 m, on tree trunk, 25.03.1985, D.J. Bickel; AMS K258775. PARATYPES: New South Wales, 1♂, Wang Wauk SF nr. Wootton, 7.04.1987, D. McAlpine, B. Day, R. de Keyzer; AMS K258792.

Diagnosis. Recognized by the fore femur being brownish on about apical half; mid and hind femora entirely brown.

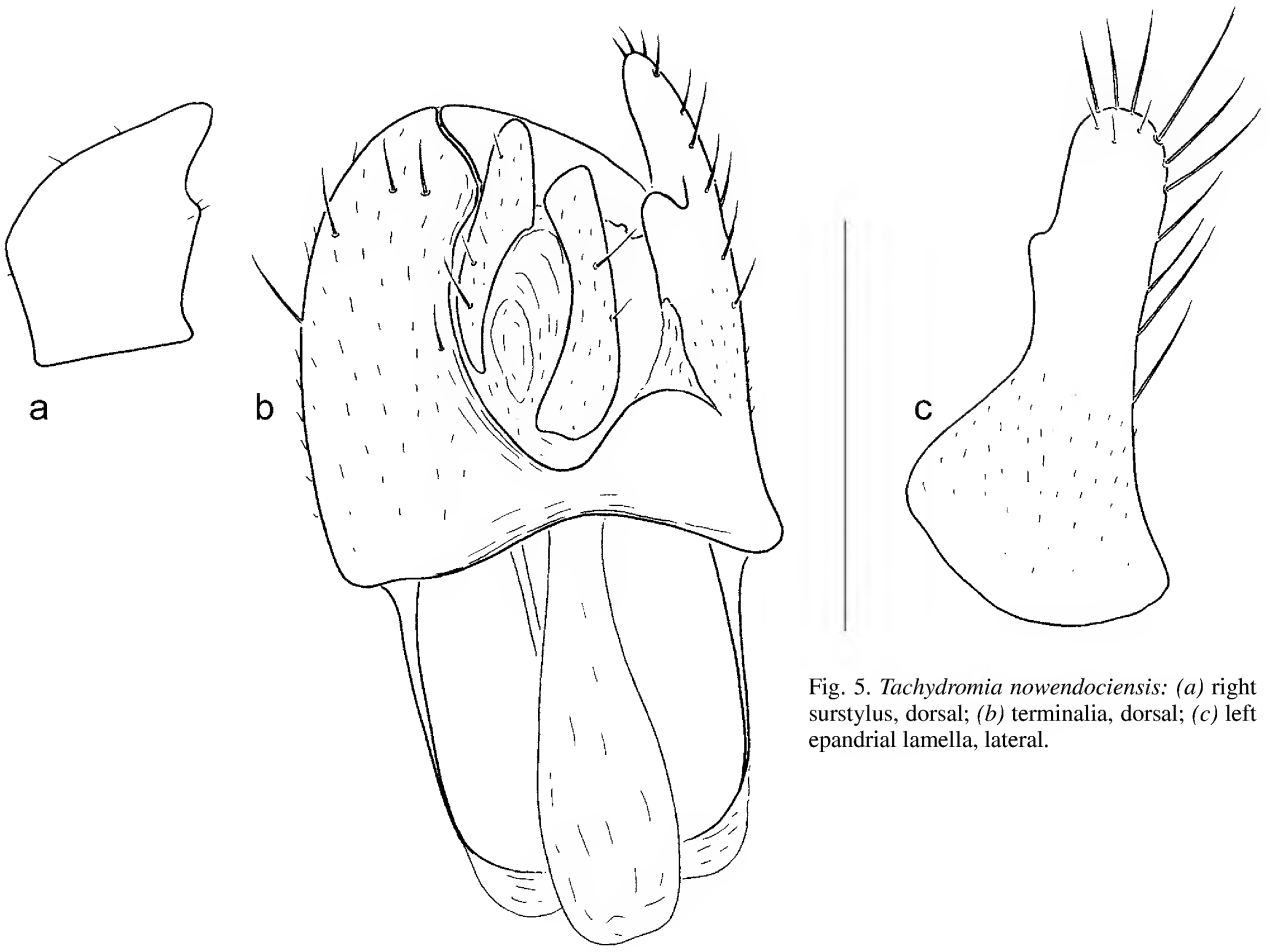

Fig. 5. *Tachydromia nowendociensis: (a)* right surstylus, dorsal; *(b)* terminalia, dorsal; *(c)* left epandrial lamella, lateral.

Description. *Male* length: body 1.8 mm, wing 1.7 mm. *Head* black in ground-colour. Eyes with posterior margin produced far beyond ocellar tubercle and almost touching on vertex; vertex narrower than frons in front of ocellar tubercle. Occiput including vertex almost entirely densely greyish pollinose, with shining patch below neck; 2 inclinate, short, black postvertical setae, some scattered short pale and black setae around neck and near mouth-opening and row of pale minute postoculars. Ocellar tubercle pollinose, with 2 moderately long lateroclinate setae. Frons greyish pollinose, slightly widened toward ocellar tubercle, above antennae slightly wider than anterior ocellus. Antenna with scape, pedicel and postpedicel dusky yellow, stylus brownish. Postpedicel drop-like, short, nearly 1.5 times as long as wide; stylus apical, very long, nearly 3.0 times as long as pedicel and postpedicel combined. Palpus unmodified, slender, rounded apically, shorter than proboscis, brownish; lacking silvery setae, with some scattered black setulae and bearing very long (nearly 1.5 times as long as palpus) black subapical seta. *Thorax* black in ground-colour, entirely finely greyish pollinose. Postpronotal lobe large, lacking conspicuous setae, with some minute setulae. Mesonotum with 1 black moderately long notopleural, 1 minute hair-like postalar and 2 cruciate scutellars (nearly as long as notopleural seta); some minute setulae present behind postpronotal lobe; mesosternum and metasternum bare between posterior four coxae. Acrostichals minute, arranged in 2 regular rows, ending before prescutellar depression. Dorsocentrals uniserial, mostly minute, prescutellar pair somewhat longer. *Legs* long, slender, with brown and yellow pattern; coxae and trochanters entirely yellow, fore femur brownish on about apical half (broader dorsally), mid and hind femora entirely brown, fore knees yellowish, fore tibia (except dorsal face) and mid tibia brownish, hind tibia brown on apical 1/3 and brownish yellow on basal 1/3, fore and mid tarsomeres 1–3 yellowish, tarsomeres 4–5 brownish yellow, hind basitarsus yellow (except brownish yellow apex), tarsomeres 2–5 brownish. Coxae with yellowish unmodified setae, finely pollinose. Fore femur thickened, pale pubescent ventrally, with dark anteroventral and posteroventral setulae becoming longer and paler basally. Fore tibia spindle-shaped. Mid femur slender, with hardly prominent swelling near base, bearing rows of short anteroventral and posteroventral spine-like setae basally (the latter somewhat stronger basally). Mid tibia with hardly prominent apical projection and ventral spinule-like setulae. Hind leg unmodified, lacking prominent setae. *Wing* normally developed, rounded at apex, with unmodified venation; two broad brownish bands connected on cells r_1 and r_{2+3} leaving narrow basal (except extreme base), apical and median hyaline spaces. One short costal bristle present. Vein R_{2+3} straight. Veins R_{4+5} and M_{1+2} parallel toward wing-apex. Crossveins r-m and bm-cu almost contiguous. Calypter dusky yellow with concolorous fringe. Halter with yellow stem and pale knob. *Abdomen* brown in ground-colour, finely greyish pollinose, covered with scattered black setae longer on pregenital segment. *Terminalia* (Fig. 5) moderately large, rather elongate oval, blackish brown. Right cercus elongate subtriangular, with

unmodified short setae. Left cercus nearly as long as right cercus, subrectangular, narrow; with several unmodified setae of different lengths. Right epandrial lamella subtriangular (viewed laterally), lacking ventral subapical process, with several unmodified setae of different lengths. Right surstylus differentiated from epandrium, bent inward, rather subtriangular, bearing several spinule-like setulae apically and on inner side. Left surstylus undifferentiated from epandrium; left epandrial lamella subtriangular, with hardly prominent dorsal projection on about middle, bearing several long subapical marginal setae. Hypandrium with 3 very short setae. Phallus short.

Female. Unknown.

Etymology. The specific epithet refers to the type locality of the new species, Nowendoc.

Distribution. *Tachydromia nowendociensis* n.sp. is currently known from two localities in New South Wales. The new species was taken from tree trunks (850 m) at the end of March and in the beginning of April.

Tachydromia papuana Grootaert, 1987

Tachydromia papuana Grootaert, 1987: 141, figs 1–7.

Material examined. NEW GUINEA: 1♂, N. Guinea: SE Popondetta Area, Sambogo Riv. 11.04.1972; River Margip; J.A. Tenorio coll. (BPBM).

Remarks. Grootaert (1987) described this species after three male specimens taken from Madang Province of Papua New Guinea. We re-examined the type material of *T. papuana* and have found that a specimen obtained from BPBM is conspecific. The female of this species remains unknown.

Distribution. Papua New Guinea.

Tachydromia sp. undetermined

Material examined. NEW SOUTH WALES: 1♀, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 28.01–13.02.1999, G. Williams; AMS K258873. 1♀, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 29.12.1998–14.01.1999, G. Williams; AMS K258754. 1♀, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 14–28.02.1999, G. Williams; AMS K258817. 2 ♀♀, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 1–30.03.1999, G. Williams; AMS K258757, K258764. 1♀, Dooragan NP, Nth Brother Mtn, 450 m, subtropical rainforest, malaise trap, 25.11–24.12.1999, G. Williams; AMS K258741. 1♀, Port Macquarie; Sea Acres NR, 0–10 m, subtropical rainforest, malaise trap, 26.01–13.02.1999, G. Williams; AMS K258818. 1♀, Port Macquarie; Sea Acres NR, 0–10 m, subtropical rainforest, malaise trap, 25.11–10.12.1999, G. Williams; AMS K258736.

Remarks. We could not associate these female specimens with males of any species mostly due to their poor condition after drying. Nevertheless, we included this material to provide additional data on the occurrence of *Tachydromia* in Australia.

Discussion

Currently six species of the genus *Tachydromia* are recorded from Australasia, including five species from Australia, which have been described in this paper, and a single species from Papua New Guinea. No species of *Tachydromia* have been found from New Zealand and Tasmania, but some untreated materials were collected from Fiji (Sinclair, pers. comm.) It is a bit surprising because many of these areas have been extensively surveyed and Tachydromiinae are well represented in samples, e.g., *Elaphropeza* Macquart and some other Drapetini.

A phylogenetic analysis of the relationships of the Australasian species of *Tachydromia* will be presented in a separate paper covering the entire group. However, we would like to give here some preliminary remarks. Australasian species of *Tachydromia* could be separated into two complexes. Five continental species belong to the *T. luang* group and form a sister-complex to species of this group that are known from Southeast Asia (Shamshev & Grootaert, 2008). Whereas *T. carnarvonensis* n.sp. (together with *T. doi, T. papuana, T. monocercus* Shamshev & Grootaert, 2008 [Thailand] and *T. mengyangensis* Grootaert, Yang & Shamshev, 2008 [China, Yunnan]) is a member of a well-supported complex of species showing some affinity to the *T. terricola* group *sensu* Chvála (1970).

It is interesting to note that species of these two complexes appear to differ from each other in their habits. *Tachydromia papuana* was taken in lowlands and swept above fine gravel along the banks of a small river. Nothing is known about *T. carnarvonensis* n.sp. but label data indicates that this species was also collected near a river. We can add that *T. mengyangensis* (China) belonging to this species complex was taken also along forest streams (Grootaert *et al.*, 2008). Some Palaearctic species of *Tachydromia* are known to occur along rivers and streams running on gravel and stones (Chvála, 1970). The remaining Australian species of *Tachydromia* were collected from tree trunks (mostly *Eucalyptus*) of cool and rainforests in mountains and submontane areas of the Great Dividing Range.

Current zoogeographical patterns and their possible history in *Tachydromia* will be a subject of a separate paper planned by the authors. The genus is currently only confined to eastern Australia, and we hypothesise here that the Australasian species possibly originated from dispersal of ancestral populations southwards from Southeast Asia.

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